

***Preliminary methodological notes and data sources  
covering the RMIS dashboard and production module***

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# 1 Aggregates

## 1.1 Resources and Reserves

Statistical data for resource & reserve distribution throughout the world are not available. Resources of aggregates are abundant and widely distributed across the globe.

## 1.2 Production of primary materials

Coverage: EU countries.

Time period of compiled data series: 2008-2019.

Reference Year: 2019.

Data source(s): (UEPG, 2021) for 2019, (UEPG, 2020) for 2018, (UEPG, 2019) for 2008-2017.

Other collected/checked/registered datasets: Information on the production of aggregates in the EU is also provided by (BGS, 2023) and (Eurostat Prodcorn, 2023a).

Notes: Global production data are not available. Data collated by UEPG for EU countries comprise natural aggregates (crushed rock, sand & gravel, marine aggregates), manufactured aggregates from industrial by-products, recycled aggregates, and aggregates reused on site. Figures refer to the total production of all forms of aggregates.

Latest RMIS Dashboard update: October 2022.

## 1.3 Production of refined/processed materials

Not applicable.

## 1.4 Additional information and insights about production

- ✓ The product mix of quarry production is obtained from (UEPG, 2021);
- ✓ The extraction sites per EU country is sourced from (UEPG, 2021).

## 1.5 Applications

Geographical scope: Europe.

Data source(s): (UEPG, 2021).

Reference Year: 2019.

Notes: Data are related to the end-use sector.

Latest RMIS Dashboard update: August 2021.

## 1.6 Trade of primary materials

Coverage: Trade data reflect products classified in headings HS 250590 and HS 251710 covering natural sand, pebbles, gravel and broken or crushed stone. Heading HS 250590 includes inter-alia feldspathic sands, clayey sands and kaolinitic sands, which are not used as aggregates. The trade of primary materials of manufactured aggregates produced from industrial wastes (e.g. iron & steel slag) captured by headings HS 251720, HS 251730, HS 261800, and HS 261900 is not included. Finally, the trade of products classified under HS 251749 and HS 250510 is not included as it is more relevant to the supply chains of other raw materials (olivine & dunite and silica, respectively).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Trade of primary materials for some countries with data missing from the WITS dataset (e.g. Oman, Bahrain) is obtained from 'mirror data', i.e. imports and exports declared by reporting partners in (UN Comtrade, 2022).

Relevant Harmonized System (HS) Codes: HS 250590 *Sands; natural, (other than silica and quartz sands), whether or not coloured, (other than metal-bearing sands of chapter 26)*; HS 251710 *Pebbles, gravel, broken or crushed stone; of a kind commonly used for concrete aggregates, for road metalling or for railway or other ballast, shingle and flint, whether or not heat-treated.*

Latest RMIS Dashboard update: August 2021.

## **1.7 Trade of refined/processed materials**

Not applicable.

## **1.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU.

Data source(s): JRC calculation based on background data from (UEPG, 2021).

Reference Year: 2019.

Notes: The indicator is calculated as the share in total production of Recycled & Re-used aggregates derived from EOL products. Secondary materials from industrial waste (manufactured aggregates) are not considered.

Latest RMIS Dashboard update: October 2022.

## **1.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 2 Aluminium

### 2.1 Resources and Reserves

#### 2.1.1 Resources

Data source(s): JRC elaboration based on (S&P, 2022).

Reference Year: 2021.

Notes: Data for Australia are sourced from (Britt, 2018), for Guinea from (Traoré *et al.*, 2014), for Greece and Romania from (Minerals4EU, 2015). Data for these countries are adjusted with the deduction of the cumulative bauxite production from the reporting year to 2021.

Latest RMIS Dashboard update: August 2023.

#### 2.1.2 Reserves

Data source(s): JRC elaboration based on (S&P, 2022).

Reference Year: 2021.

Notes: Data for Australia are sourced from (Britt, 2018), for Guinea from (Traoré *et al.*, 2014), for Greece and Romania from (Minerals4EU, 2015). Data for these countries are adjusted with the deduction of the cumulative bauxite production from the reporting year to 2021.

Latest RMIS Dashboard update: August 2023.

### 2.2 Production of primary materials

Coverage: World countries

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-bauxite, 2022) (2011-2020).

Notes: Data reflect the production of bauxite.

Latest RMIS Dashboard update: August 2023.

### 2.3 Production of refined/processed materials

#### 2.3.1 Alumina

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (USGS myb-bauxite, 2022) (2011-2020), (IAI, 2023b) (2000-2022).

Notes: Where possible, figures represent the  $Al_2O_3$  equivalent of aluminium oxide trihydrate produced, whether or not calcined. Production figures include both metallurgical-grade alumina and chemical-grade alumina.

Latest RMIS Dashboard update: August 2023.

#### 2.3.2 Primary Aluminium

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2008-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (IAI, 2023b) (2000-2022).

Notes: Production data by country represent primary aluminium.

Latest RMIS Dashboard update: August 2023.

Production data refer to primary aluminium, i.e. the molten metal tapped from electrolytic cells or pots during the electrolytic reduction of metallurgical alumina.

### **2.3.3 Aluminium Ingots**

Coverage: World total and EU total.

Time period of compiled data series: 2000-2021 for global, 2008-2021 for the EU.

Reference Year: 2021.

Data source(s): (IAI, 2023a), (Eurostat Prodcum, 2023b).

Other collected/checked/registered datasets: -

Notes: Production of aluminium ingots comprises primary and secondary ingots (from old and new scrap). PRC codes used for the EU output: 24421130 *Unwrought non-alloy aluminium (excluding powders and flakes)*, 24421153 *Unwrought aluminium alloys in primary form (excluding aluminium powders and flakes)*, 24421154 *Unwrought aluminium alloys (excluding aluminium powders and flakes)*, 24421155 *Unwrought aluminium alloys in secondary form (excluding aluminium powders and flakes)*.

Latest RMIS Dashboard update: August 2023.

## **2.4 Additional information and insights about production**

- ✓ The breakdown of bauxite output by grade is elaborated from (Flook, 2018);
- ✓ The global production of unwrought aluminium by source is sourced from (IAI, 2023a);
- ✓ The EU production of unwrought aluminium by product category is derived from (Eurostat Prodcum, 2023b);
- ✓ The calculation of CAGR is based on primary aluminium production (2012-2021).

## **2.5 Applications**

Geographical scope: EU.

Data source(s): (European Aluminium, 2018).

Reference Year: 2017.

Notes: Data reflect end-use sectors.

Latest RMIS Dashboard update: August 2021.

## **2.6 Trade of primary materials**

Coverage: Bauxite's trade of primary materials is represented by HS 260600.

Data source(s): (UN Comtrade, 2022) is used instead of (WITS, 2021) due to the observed discrepancies in the latter.

Reference Year: 2019.

Notes: Exports originating from Guinea, Solomon Islands and Sierra Leone, are deduced from reported imports by trade partners. Trade flows of Iran, Guyana, Mozambique and Ukraine for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 260600 *Aluminium ores and concentrates*.

Latest RMIS Dashboard update: August 2021.

## 2.7 Trade of refined/processed materials

Coverage: Trade data for refined/processed aluminium products are linked to the product aggregate of HS 760110 and HS 760120 covering unwrought aluminium (primary and secondary aluminium). The trade of refined alumina products is not included in the aggregate as it is presented in bauxite. Trade of aluminium powders and flakes (HS 760310, HS 760320), as well as of semi-finished products, is excluded.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports and imports of Azerbaijan, Bahrain, Montenegro, Oman, Cameroon, Qatar, and Venezuela are derived from data reported by their trade partners. In the same way, Iran's, Mozambique's and Ukraine's trade data for 2019 are deduced from declared imports and exports by their trade partners.

Relevant Harmonized System (HS) Codes: HS 760110 *Aluminium; unwrought, (not alloyed)*; HS 760120 *Aluminium; unwrought, alloys*

Latest RMIS Dashboard update: August 2021.

## 2.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: Europe.

Data source(s): JRC calculation based on background data from (IAI, 2023a).

Reference Year: 2021.

Notes: Data are sourced from Alucycle, the International Aluminium Institute's global material flow model built on aluminium industry's data (Bertram *et al.*, 2017).

Latest RMIS Dashboard update: July 2021.

## 2.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **3 Antimony**

### **3.1 Resources and Reserves**

#### **3.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023

#### **3.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **3.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-Sb, 2022) (2000-2018)

Notes: It is deducted from the compiled information that production data reflect the antimony content of Sb-bearing ores and concentrates (e.g. of antimony, lead).

Latest RMIS Dashboard update: August 2023.

### **3.3 Production of refined/processed materials**

Production data of commercial forms of refined antimony are not available.

### **3.4 Additional information and insights about production**

- ✓ The refined antimony production capacity is sourced from (Schwarz-Schampera, 2014) (data from Roskill);
- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **3.5 Applications**

Geographical scope: Europe.

Data source(s): (European Commission, 2014a), data from Roskill (2012).

Reference Year: NA.

Notes: End uses of antimony. Data for antimony's applications in the EU by end-use sectors/markets are also provided by the EC MSA study (BIO by Deloitte, 2015).

Latest RMIS Dashboard update: August 2021.

### 3.6 Trade of primary materials

Coverage: Data correspond to HS heading 261710. Trade of primary materials of Sb-bearing residues from non-ferrous metallurgy used to extract antimony or manufacture its chemical compounds is not included; the related heading HS 262091 refers to slag ashes and residues containing many metals.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: As no data are available for exports originating from Tajikistan, Bolivia and Myanmar despite being among the top producers worldwide, these countries' exports are derived from reported imports by destination countries in the UN Comtrade database (UN Comtrade, 2022). Mozambique's trade flows are derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 261710 *Antimony ores and concentrates*.

Latest RMIS Dashboard update: August 2021.

### 3.7 Trade of refined/processed materials

Coverage: Aggregate of HS 282580 and HS 811010 covering antimony oxides and unwrought antimony metal and powders, respectively. Trade of various antimony compounds (e.g. sulphides in HS 283090, chlorides in HS281219) are not included as they are reported together with several compounds of other materials. Wrought antimony in article forms (HS 811090) and antimonial lead (HS 780191) are also not counted in the aggregate.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports of Myanmar and Bolivia are derived from imports reported by destination countries. Iran's and Ukraine's trade for 2019 is deduced from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 282580 *Antimony oxides*; HS 811010 *Antimony and articles thereof; unwrought antimony, powders*.

Latest RMIS Dashboard update: August 2021.

### 3.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: The indicator is calculated from background data provided by the source according with the methodology described in (Peiró *et al.*, 2018).

Latest RMIS Dashboard update: August 2021.

### 3.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).



## 4 Arsenic

### 4.1 Resources and Reserves

World resources and reserves data are unavailable. The commercial production of arsenic is closely tied to the extraction of ores containing other metals such as copper and gold.

### 4.2 Production of primary materials

No data are available as arsenic is primarily produced as a by-product. The extraction of arsenic mostly relies on the extraction of ores containing copper and gold; the by-products of smelting are then processed and refined to extract the arsenic.

### 4.3 Production of refined/processed materials

#### 4.3.1 Arsenic (white)

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-As, 2022) (2011-2021).

Notes: As deduced from background information provided by the data sources, production data are associated with the output of arsenic trioxide and other compounds of elemental arsenic as  $As_2O_3$  equivalent.

Latest RMIS Dashboard update: August 2023.

### 4.4 Additional information and insights about production

- ✓ The CAGR refers to refinery production (2012-2021).

### 4.5 Applications

Geographical scope: EU.

Data source(s): (ECHA, 2010).

Reference Year: Annual average 2008-2010.

Notes: Applications are derived from data on volumes of  $As_2O_3$  placed on the European market provided by the industry (the REACH Arsenic and Arsenic Compounds Consortium) during the public consultation on the recommendation to include diarsenic trioxide in Annex XIV of REACH Regulation. Figures are related to the end uses of arsenic.

Latest RMIS Dashboard update: August 2021.

### 4.6 Trade of primary materials

Trade data for arsenic's primary materials are not available in the HS nomenclature. Arsenic is mostly extracted as a by-product from copper and lead smelting and refining. HS 262060 addresses trade of flue dusts from copper or lead smelting containing arsenic. However, this heading also covers the trade of slag, ashes and residues containing mercury and thallium; therefore, trade flows of As-rich materials cannot be identified. Furthermore, the trade of natural arsenic sulphides (realgar, orpiment, arsenopyrite) cannot be accounted, as the relevant HS heading 253090 aggregates many minerals.

#### **4.7 Trade of refined/processed materials**

Coverage: HS 280480 is considered covering common arsenic (so-called 'metallic') and yellow arsenic. Arsenic compounds such as arsenic acid, diarsenic trioxide and pentoxide, gallium arsenide etc., and Pb-As alloys are not included due to the high aggregation of the relevant HS headings (HS 281119, HS 281129, HS 281390, HS 780199) with compounds of other materials.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners in (UN Comtrade, 2022).

Relevant Harmonized System (HS) Codes: HS 280480 *Arsenic*.

Latest RMIS Dashboard update: August 2021.

#### **4.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: World.

Data source(s): JRC assessment based on (UNEP, 2011).

Reference Year: NA.

Notes: No data are available for the EU or globally. Arsenic's EOL-RIR is deduced from (UNEP, 2011), and it is supposed to be applicable also in the EU.

Latest RMIS Dashboard update: August 2023.

#### **4.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 5 Baryte

### 5.1 Resources and Reserves

#### 5.1.1 Resources

Data on the distribution of world's baryte resources are not available in the public domain.

#### 5.1.2 Reserves

Data source(s): (USGS, 2023).

Reference Year: 2022.

Notes: Reserves are defined according to the USGS classification system (USGS, 1980).

Latest RMIS Dashboard update: August 2023.

### 5.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2020, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (USGS myb-barite, 2022) for 2014-2020.

Notes: Data refer to the first marketable baryte product that includes crude barite (run-of-mine) and products of simple beneficiation methods. Along with baryte minerals (barium sulphate), data may include small quantities of witherite (barium carbonate).

Latest RMIS Dashboard update: August 2023.

### 5.3 Production of refined/processed materials

Statistics on the production of processed forms of barium minerals (e.g. various barium compounds) are not available.

### 5.4 Additional information and insights about production

- ✓ The CAGR is about primary (mining) production (2012-2021).

### 5.5 Applications

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: Data are relevant to products 'used' (end uses).

Latest RMIS Dashboard update: August 2021.

## 5.6 Trade of primary materials

Coverage: Data concern the trade of natural barium sulphate (barytine) (HS 251110). The trade of natural barium carbonate (witherite) (HS 251120) is not considered.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's, Guyana's, Mozambique's and Ukraine's Trade of primary materials flows for 2019 is derived from declared imports and exports by reporting partners in (UN Comtrade, 2022).

Relevant Harmonized System (HS) Codes: HS 251110 *Barium sulphate (barytes); natural*

Latest RMIS Dashboard update: August 2021.

## 5.7 Trade of refined/processed materials

Coverage: Trade data cover precipitated barium sulphate (HS 283327) and precipitated barium carbonate (HS 283660). Trade data for other barium compounds such as oxides, hydroxides, and peroxides (HS 281640), sulphides (HS 283090), and barium metal (HS 280519) are excluded as barium compounds are reported together with compounds of other materials in the respective HS headings.

Data source(s): (WITS, 2021)

Reference Year: 2019.

Notes: Mozambique's, Iran's, Guyana's, and Ukraine's trade for 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 283327 *Sulphates; of barium*; HS 283660 *Carbonates; barium carbonate*.

Latest RMIS Dashboard update: August 2021.

## 5.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: The indicator is calculated from background data reported by the source along with the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020)

Latest RMIS Dashboard update: August 2021.

## 5.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **6 Bentonite**

### **6.1 Resources and Reserves**

Available country-specific data are incomplete to allow a full global coverage.

### **6.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (USGS myb-Clays, 2022) (2006-2021), (BGS, 2023) (2006-2021).

Notes: Chinese production in 2015-2021 is sourced from (USGS myb-Clays, 2022).

Latest RMIS Dashboard update: August 2023.

### **6.3 Production of refined/processed materials**

No data are available for activated bentonites.

### **6.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **6.5 Applications**

Geographical scope: Europe.

Data source(s): (IMA Europe, 2018);(IMA Europe, 2019).

Reference Year: 2017.

Notes: Data relate to end-use applications.

Latest RMIS Dashboard update: August 2021.

### **6.6 Trade of primary materials**

Coverage: HS 250810.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's, Guyana's, Mozambique's, and Ukraine's Trade of primary materials data originate from declared imports and exports by reporting partners (UN Comtrade, 2022).

Relevant Harmonized System (HS) Codes: HS 250810 *Bentonite*.

Latest RMIS Dashboard update: August 2021.

## **6.7 Trade of refined/processed materials**

The trade of acid activated bentonite and organophilic bentonites is not considered as these products are classified in highly aggregated HS headings (HS 380290 and HS 382499, respectively).

## **6.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Data in order to calculate the EOL-RIR of bentonite are missing.

## **6.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 7 Beryllium

### 7.1 Resources and Reserves

Global resources and reserves of beryllium are not closely documented. Available information is incomplete as data only for selected countries are available in publications such as (Trueman, D.L. and Sabey, 2014); hence, it is preferable not to present partial data.

### 7.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (USGS myb-Be, 2022).

Other collected/checked/registered datasets: (WMD, 2023) (2006-2021), (BGS, 2023) (2000-2021), (USGS, 2022) (2005-2021, in Be content)

Notes: -

Latest RMIS Dashboard update: August 2023.

### 7.3 Production of refined/processed materials

#### 7.3.1 Refined beryllium

Coverage: World countries.

Time period of compiled data series: 2012-2018.

Reference Year: 2018.

Data source(s): JRC estimates based on (USGS myb-Be, 2018).

Other collected/checked/registered datasets:

Notes: Data on the production of refined beryllium are limited. US production of refined beryllium products is estimated from the annual consumption of beryllium ores and concentrates (as calculated from mine shipments, net trade, and industry stocks) and a metallurgical yield assumption of 70%. Japan's production level is estimated on the basis of information in (BRGM, 2016). Kazakhstan's production uses as feedstock stockpiles of beryllium concentrates.

Latest RMIS Dashboard update: August 2023.

### 7.4 Additional information and insights about production

- ✓ The global production capacity for refined beryllium per product type is obtained from (BRGM, 2016) (Beryllium Science & Technology Association (BeST) data);
- ✓ The CAGR refers to primary (mining) production.

### 7.5 Applications

Geographical scope: EU28.

Data source(s): Data from BeST in EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2014.

Notes: End uses of beryllium by industrial segment.

Latest RMIS Dashboard update: August 2021.

## 7.6 Trade of primary materials

Data on the international trade of primary beryllium materials are not available as Be-bearing ores and concentrates, and metallurgical residues from which beryllium can be extracted or recovered as a by-product, are classified in headings HS 261790 and HS 262091, respectively, that comprise several materials along with beryllium.

## 7.7 Trade of refined/processed materials

Coverage: HS 811212 covering beryllium in all of its forms, i.e. unwrought and powders and beryllium articles. Beryllium oxides & hydroxides and other compounds (e.g. beryllium fluoride) are not included due to the high aggregation of the HS headings they are classified in (e.g. HS 282590, HS 282619). Be-Cu master alloys and wrought cupro-beryllium alloys are excluded as semi-fabricated products.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes:

Relevant Harmonized System (HS) Codes: HS 811212 *Beryllium and articles thereof; unwrought beryllium, powders.*

Latest RMIS Dashboard update: August 2021.

## 7.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: The indicator is calculated from background data delivered by the source and using the methodology described in (Peiró *et al.*, 2018) .

Latest RMIS Dashboard update: August 2021.

## 7.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).



## **8 Bismuth**

### **8.1 Resources and Reserves**

#### **8.1.1 Resources**

Quantitative estimates of resources are not available. Bismuth is most often a by-product of the processing of lead ores. It can also be produced from bismuthinite, a common bismuth mineral.

#### **8.1.2 Reserves**

Data source(s): (USGS, 2017).

Reference Year: 2016.

Notes: Reserves are defined according to the USGS classification system (USGS, 1980). More recent publications of USGS do not report estimates of world reserves of bismuth. Bismuth reserves are evaluated on the basis of bismuth content of lead reserves.

Latest RMIS Dashboard update: August 2023.

### **8.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-Bi, 2023) (2000-2015).

Notes: It is deduced from background information that data refer to both by-product production and production from bismuth minerals as principal product. Production figures for Bulgaria (2006-2013) and Romania (2006-2007) are sourced from (BGS, 2023), and for Japan in 2000-2005 from (USGS myb-Bi, 2023). The reported output by the data source of Japan in 2006-2021 is not considered as it relates to metal production according to (BGS, 2023).

Latest RMIS Dashboard update: August 2023.

### **8.3 Production of refined/processed materials**

#### **8.3.1 Refined bismuth**

Coverage: World countries.

Time period of compiled data series: 2000-2021

Reference Year: 2021.

Data source(s): (USGS myb-Bi, 2023)

Other collected/checked/registered datasets: (USGS mcs, 2023) (2016-2021)

Notes: Production of Peru in 2016-2021 is sourced from (BGS, 2023) (metal production). The output of Belgium in 2014 is taken from (Elsner, 2015), whereas in 2008-2013 and 2015-2021 it is hypothesized to be equal to the average production in 2000-2007.

Latest RMIS Dashboard update: August 2023.

### **8.4 Additional information and insights about production**

- ✓ The CAGR relates to refinery production (2012-2021).

## 8.5 Applications

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes:

Latest RMIS Dashboard update: August 2021.

## 8.6 Trade of primary materials

Data in international trade statistics (HS) on bismuth's primary raw materials are not available. Ores and concentrates in which bismuth is the principal constituent are classified under HS 261790; however, the heading does not exclusively refer to bismuth minerals as it covers ores and concentrates of several materials. Most important, bismuth is predominantly a by-product of Pb metallurgy (as well of W and Sn processing). International statistics do not provide the required detail to identify the trade of Bi-bearing raw materials in their host commodities.

## 8.7 Trade of refined/processed materials

Coverage: Data are linked to HS 810600 covering unwrought bismuth metal and powders, bismuth articles such as fusible alloys, and bismuth waste and scrap. Data relating to the trade of various bismuth inorganic compounds such as bismuth nitrate, bismuth carbonate and bismuth oxides such as dibismuth trioxide, are not included due to the high aggregation of the relevant HS headings (HS 283699, HS 282499, HS 282590). Similarly, trade of Bi-bearing unrefined lead bullion cannot be tracked by international statistics (HS 780199).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: No 'mirror' trade data are employed.

Relevant Harmonized System (HS) Codes: 810600 *Bismuth; articles thereof, including waste and scrap.*

Latest RMIS Dashboard update: August 2021.

## 8.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: The indicator is calculated from background data provided by the source in line with the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020).

Latest RMIS Dashboard update: August 2021.

## 8.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **9 Boron**

### **9.1 Resources and Reserves**

#### **9.1.1 Resources**

Data source(s): (Helvacı, 2005), (Helvacı, 2017).

Reference Year: NA.

Notes: Total world resources.

Latest RMIS Dashboard update: August 2021.

#### **9.1.2 Reserves**

Data source(s): (Helvacı, 2005), (Helvacı, 2017).

Reference Year: NA.

Notes: Known economic reserves. Data of partial coverage are also provided by (USGS mcs, 2023).

Latest RMIS Dashboard update: August 2021.

### **9.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005. Data for Russia (in 2006-2010) and Kazakhstan (in 2011-2015) are sourced from (USGS myb-B, 2022).

Other collected/checked/registered datasets: (USGS myb-B, 2022) (2000-2021), (BGS, 2023) (2006-2021).

Notes: Data concern the production of various boron minerals (borates).

Latest RMIS Dashboard update: August 2023.

### **9.3 Production of refined/processed materials**

#### **9.3.1 Refined borates**

Available information on the production of refined borates and boron compounds worldwide is little. Data for EU production is sourced from (Eurostat Prodcum, 2023b).

### **9.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **9.5 Applications**

Geographical scope: EU.

Data source(s): (IMA Europe, 2016).

Reference Year: 2012.

Notes: Figures relate to demand from the EU manufacturing industries using borates.

Latest RMIS Dashboard update: August 2021.

## 9.6 Trade of primary materials

Coverage: HS 252800 covering natural borates (sodium and non-sodium boron minerals). The heading records trade of only natural borate minerals as extracted, concentrates (whether or not calcined) of such materials, and natural boric acid as obtained by evaporation of natural vapours.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's, Guyana's, Mozambique's and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners in (UN Comtrade, 2022).

Relevant Harmonized System (HS) Codes: HS 252800 *Natural borates and concentrates thereof (whether or not calcined), but not including borates separated from natural brine; natural boric acid containing not more than 85 % of H<sub>3</sub>BO<sub>3</sub> calculated on the dry weight*.

Latest RMIS Dashboard update: August 2021.

## 9.7 Trade of refined/processed materials

Coverage: Data represent boric acid produced either by acid decomposition of natural borates, or by physicochemical treatment of crude boric acid (HS 281000), and borates obtained by crystallization or by a chemical process from natural borates or by evaporating brines in salt lakes (aggregate of HS 284011, HS 284019, HS 284020, HS 284030). Boron is not included as it is reported within heading HS 280450 alongside tellurium.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Mozambique's, Iran's, Guyana's, and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 281000 *Oxides of boron; boric acids*; HS 284011 *Borates; disodium tetraborate (refined borax), anhydrous*; HS 284019 *Borates; disodium tetraborate (refined borax), other than anhydrous*; HS 284020 *Borates; n.e.c. in heading no. 2840*; HS 284030 *Peroxyborates (perborates)*.

Latest RMIS Dashboard update: August 2021.

## 9.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: World.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: The indicator is calculated from background data provided by the source in line with the methodology described in (Peiró *et al.*, 2018).

Latest RMIS Dashboard update: August 2021.

## 9.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 10 Cadmium

### 10.1 Resources and Reserves

Quantitative estimates of cadmium reserves are not available. As cadmium is primarily produced as a byproduct of zinc mining and refining, the distribution of zinc resources and reserves worldwide (see 98.1) is also indicative for cadmium.

### 10.2 Production of primary materials

Cadmium production is closely tied to the production of zinc, with most of the cadmium primary supply coming from the same mines and refineries that produce zinc metal. Due to its by-product nature, mine production statistics are not available.

### 10.3 Production of refined/processed materials

#### 10.3.1 Refined cadmium

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (USGS myb-Cd, 2022) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2000-2021), (USGS myb-Cd, 2022) (2006-2020)

Notes: -

Latest RMIS Dashboard update: August 2023.

### 10.4 Additional information and insights about production

- ✓ The CAGR refers to refinery production (2012-2021).

### 10.5 Applications

Geographical scope: World.

Data source(s): (ICdA, 2021).

Reference Year: 2019.

Notes: End uses of cadmium. EU-specific data are not available. It is assumed that figures are also applicable to the EU.

Latest RMIS Dashboard update: August 2021.

### 10.6 Trade of primary materials

No data are available on the international trade of cadmium's primary materials. Cadmium is not mined directly from one particular ore, but is instead recovered as by-product of zinc's metallurgy. The trade of cadmium-bearing metallurgical residues cannot be traced by the Harmonised System's nomenclature as the relevant HS heading (HS 262091) comprises compounds of many materials.

## 10.7 Trade of refined/processed materials

Coverage: HS 810720 is used for cadmium's world trade that refers to unwrought cadmium and cadmium powders. Cadmium compounds (e.g. cadmium oxide in HS 282590, sulphates of cadmium in HS 283329, cadmium sulphide in HS 283090) are not included due to the high aggregation of the relevant HS headings. Wrought cadmium and articles are excluded (HS 810790) as considered to be downstream products.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports of Mexico are derived from reported imports by trade partners.

Relevant Harmonized System (HS) Codes: HS 810720 *Cadmium; unwrought, powders*.

Latest RMIS Dashboard update: August 2021.

## 10.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: World.

Data source(s): JRC estimate based on (UNEP, 2011).

Reference Year: NA.

Notes: Robust data that allow the calculation of cadmium's EOL-RIR are not available. The EOL-RIR is assessed at 13% (ranging from 5% to 25%), according with the guidance provided in the methodology for establishing the EU List of Critical Raw Materials (Blengini *et al.*, 2017) and data from (UNEP, 2011). The estimate figure for the EOL-RIR is derived from the median recycled content (RC) and the median old scrap ratio (OSR) of the ranges reported by (UNEP, 2011) for cadmium. It is assumed that the estimated figure is also appropriate for the EU.

Latest RMIS Dashboard update: August 2021.

## 10.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 11 Cerium

### 11.1 Resources and Reserves

No data are available (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements).

### 11.2 Production of primary materials

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and cerium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of cerium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### 11.3 Production of refined/processed materials

Data are not available in the public domain.

### 11.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 11.5 Applications

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data relate to cerium's demand by end use.

Latest RMIS Dashboard update: August 2023.

### 11.6 Trade of primary materials

No HS codes are representative for the trade of cerium's primary materials. See also the generic notes provided for REEs.

### 11.7 Trade of refined/processed materials

Coverage: Data refer to HS 284610 covering ceric oxide and cerium salts. The trade of intermixtures/interalloys containing cerium such as 'mischmetal' (containing Ce, La, etc.) is not included as the relevant trade code (HS 280530) is highly aggregated. Trade of ferro-cerium is also not possible to be accounted for the same reason (HS 360690).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports of Malaysia are deduced by declared imports by destination countries. Iran's and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 284610 *Cerium compounds*

Latest RMIS Dashboard update: August 2021.

### **11.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Available data are insufficient to calculate a figure for the EOL-RIR in the EU.

### **11.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).



## **12 Chromium**

### **12.1 Resources and Reserves**

#### **12.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **12.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **12.2 Production of primary materials**

Coverage: World countries

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, JRC estimate based on (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (ICDA, 2019) (2004-2018).

Notes: Production data from 2000 to 2005 reported by (BGS, 2023) in gross weight of chromium concentrates are converted to  $\text{Cr}_2\text{O}_3$  content using a global average content in chrome concentrates of 43%. Production of Finland in 2000-2021 is derived from (BGS, 2023) using reserves' grade when production is reported as gross weight of chromium ore, and the average  $\text{Cr}_2\text{O}_3$  content of chromium concentrates in Finland when production is reported in gross weight of chromium concentrates.

Latest RMIS Dashboard update: August 2023.

### **12.3 Production of refined/processed materials**

#### **12.3.1 Chromium ferroalloys**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (USGS myb-ferroalloys, 2023) (2000-2020), (USGS myb-Cr, 2022) (2000-2021), (ICDA, 2019) (2004-2018).

Notes: Data reflect the production of chromium ferroalloys in gross weight, comprising ferro-chrome (FeCr) and ferro-silico-chrome (FeSiCr).

Latest RMIS Dashboard update: August 2023.

### **12.3.2 Ferrochrome**

Coverage: World countries.

Time period of compiled data series: 2000-2021

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (USGS myb-ferroalloys, 2023), (2000-2020), (USGS myb-Cr, 2022) (2000-2021), (ICDA, 2019) (2004-2018).

Notes: Data concern the production of ferro-chrome (FeCr). Chinese ferro-chrome production from 2010 to 2021 is obtained from USGS. USGS is also the source for South Africa's ferro-chrome output from 2015 to 2021.

Latest RMIS Dashboard update: August 2023.

### **12.3.3 Ferro-silico-chrome**

Coverage: World countries.

Time period of compiled data series: 2000-2021

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (USGS myb-ferroalloys, 2023) (2000-2020), (USGS myb-Cr, 2022) (2000-2021), (ICDA, 2019) (2004-2018).

Notes: Data refer to the production of ferro-silico-chrome (FeSiCr). Russia's production of ferro-silico-chrome from 2010 to 2020 is sourced from USGS.

Latest RMIS Dashboard update: August 2023.

## **12.4 Additional information and insights about production**

- ✓ Chromite's production by grade is sourced from (ICDA, 2019);
- ✓ The production of chromium ferroalloy products is obtained from (ICDA, 2019);
- ✓ The production capacity of chromium metal is collected from (USGS myb-Cr, 2022) (data from the 2021 edition);
- ✓ The production capacity of chromium metal is gathered from (USGS myb-Cr, 2022) (data from the 2021 edition);
- ✓ The CAGR is based on chromite mine production (2012-2021).

## **12.5 Applications**

Geographical scope: World.

Data source(s): (ICDA, 2017).

Reference Year: 2017.

Notes: First uses of chromium. It is regarded that figures are applicable in the EU. The EC MSA study also provides data for chromium's applications in 2013 in the EU (BIO by Deloitte, 2015).

Latest RMIS Dashboard update: August 2021.

## **12.6 Trade of primary materials**

Coverage: HS 261000 addressing trade of chromite.

Data source(s): (WITS, 2021)

Reference Year: 2019.

Notes: Iran's, Ukraine's and Mozambique's trade is derived from declared imports and exports by reporting partners in (UN Comtrade, 2022).

Relevant Harmonized System (HS) Codes: HS 261000 *Chromium ores and concentrates*.

Latest RMIS Dashboard update: August 2021.

## 12.7 Trade of refined/processed materials

Coverage: Aggregate of HS 281910, HS 281990, HS 284130, HS 284150, HS 720241, HS 720249, HS 720250 and HS 811221. Products covered comprise chromium traded in the form of oxides, chromates, in all types of ferrochrome, chromium alloys and chromium metal.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's, Mozambique's and Ukraine's trade for 2019 is estimated from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 281910 *Chromium trioxide*; HS 281990 *Chromium oxides and hydroxides; excluding chromium trioxide*; HS 284130 *Salts; sodium dichromate*; HS 284150 *Salts; chromates, dichromates, peroxochromates; n.e.c. in heading no. 2841*; HS 720241 *Ferro-alloys; ferro-chromium, containing by weight more than 4% of carbon*; HS 720249 *Ferro-alloys; ferro-chromium, containing by weight 4% or less of carbon*; HS 720250 *Ferro-alloys; ferro-silico-chromium*; HS 811221 *Chromium and articles thereof; unwrought chromium, powders*.

Latest RMIS Dashboard update: August 2021.

## 12.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: Consistent with the methodology described in (Peiró *et al.*, 2018), the indicator is calculated from background data delivered by the source.

Latest RMIS Dashboard update: August 2021.

## 12.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **13 Cobalt**

### **13.1 Resources and Reserves**

#### **13.1.1 Resources**

Coverage: World countries.

Data source(s): JRC elaboration based on (S&P, 2022) and (Mudd *et al.*, 2013).

Reference Year: 2021.

Notes: Data reported by (Mudd and Jowitt, 2022) provide a comprehensive picture of potentially recoverable cobalt. These are adjusted taking into account the cumulative cobalt mine production from 2012 to 2021 and compared with code-compliant data from (S&P, 2022). The greatest value for an individual country between (S&P, 2022) and amended data from (Mudd *et al.*, 2013) is selected for an individual country.

Latest RMIS Dashboard update: August 2023

#### **13.1.2 Reserves**

Coverage: World countries.

Data source(s): (S&P, 2022).

Reference Year: 2020.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2021.

### **13.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-Co, 2023) (2000-2020)

Notes:

Latest RMIS Dashboard update: August 2023.

### **13.3 Production of refined/processed materials**

#### **13.3.1 Refined cobalt**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (USGS myb-Co, 2023) (2000-2020), (Cobalt Institute, 2019) (2011-2018), (Eurostat Prodcom, 2023b).

Notes: Figures include the production of cobalt metal plus the cobalt content of refined compounds (oxides, carbonates, sulphates and other). Data comprise production from both primary and secondary raw materials. The split in refined cobalt production between Belgium and China is achieved using data from (USGS myb-Co, 2023) for 2013-2020, and (Roskill, 2014) for 2012; for other years it is assessed through capacity data.

Latest RMIS Dashboard update: August 2023.

### 13.4 Additional information and insights about production

- ✓ The host metals from which cobalt is produced as a by-product is sourced from (JRC, 2021). Data include an estimate for artisanal and small-scale mining (ASM) where cobalt is the primary commodity;
- ✓ The mine capacity by product is obtained from (JRC, 2021);
- ✓ The calculation of CAGR is based on refined cobalt production (2012-2021).

### 13.5 Applications

Geographical scope: World.

Data source(s): (Cobalt Institute, 2023).

Reference Year: 2022.

Notes: Figures show cobalt's end uses. The breakdown of demand is supposed to be applicable to the EU. The EC MSA study (Matos, Ciacci, *et al.*, 2020) provides EU-specific information for the end uses of cobalt in 2016.

Latest RMIS Dashboard update: August 2023.

### 13.6 Trade of primary materials

Coverage: Data are associated with HS 260500 that covers cobalt ores and concentrates, i.e. ores and concentrates in which cobalt is the primary commodity. The trade of Co-bearing copper and nickel ores, concentrates and intermediates is not possible to be captured by international trade statistics. Cobalt intermediates, such as cobalt mattes destined for cobalt refining, produced after the initial metallurgical processing of Co-bearing ores are not included as they are reported along with refined cobalt products in the relevant HS heading (HS 810520), and the code is allocated to processed/refined materials of cobalt. Similarly, the heading HS 282200, which covers inter-alia crude cobalt hydroxides obtained from the metallurgical processing of Co-bearing copper ores, is not included as refined Co oxides are reported within the HS heading, and the code is assigned to processed/refined materials. Finally, the trade of contained cobalt in nickel intermediates, such as mixed nickel sulphide precipitate (MSP) and mixed nickel hydroxide precipitate (MHP) captured by headings HS 283090 and HS 282540 correspondingly, is excluded as these codes are allocated to nickel.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports from DRC are derived from reported imports from destination countries (mirror exports). Also, Finland's imports are sourced from the Finnish Customs (ULJAS, 2021).

Relevant Harmonized System (HS) Codes: HS 260500 *Cobalt ores and concentrates*

Latest RMIS Dashboard update: August 2021.

### 13.7 Trade of refined/processed materials

Coverage: For the trade of refined cobalt, the aggregate of HS 282200 and HS 810520 is employed, containing cobalt oxides such as cobalt tetroxide, and unwrought cobalt, cobalt alloys and cobalt powders, respectively. It is noted that the above codes cover inter-alia the Co-rich intermediates obtained from the initial metallurgical processing of Co-bearing ores and concentrates, e.g. crude cobalt hydroxide and cobalt mattes. The trade of other refined cobalt compounds, e.g. cobalt sulphate, cobalt carbonate and cobalt chlorides, is not included as they are reported in HS headings aggregated with compounds of different materials (i.e. HS 283329, HS 282739, and HS 283699, correspondingly). Cobalt articles and cobalt in wrought forms is excluded (HS 810590).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports from DRC, New Caledonia, and Norway are derived from reported imports by destination countries. Trade flows from Finland (imports, exports) are sourced from (UN Comtrade, 2022) in the form of 'mirror' imports and 'mirror' exports based on the declared exports and imports, respectively, of its trade partners. Eurostat does not provide data for Finland, while from the datasets provided by the Finish Customs (ULJAS, 2021) is not possible to separate EU-Extra and EU-Intra trade. Iran's, Mozambique's and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Iran's, Mozambique's and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 282200 *Cobalt oxides and hydroxides; commercial cobalt oxides*; HS 810520 *Cobalt; mattes and other intermediate products of cobalt metallurgy, unwrought cobalt, powders*.

Latest RMIS Dashboard update: August 2021.

### **13.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU.

Data source(s): EC MSA study (Matos, Ciacci, *et al.*, 2020).

Reference Year: 2016.

Notes: On the basis of the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020), the indicator is calculated from background data provided by the source.

Latest RMIS Dashboard update: August 2021.

### **13.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **14 Coking coal**

### **14.1 Resources and Reserves**

#### **14.1.1 Resources**

Comprehensive resource estimates for coking coal are not available.

#### **14.1.2 Reserves**

Data source(s): JRC estimate based on data from (BP, 2020).

Reference Year: 2019.

Notes: Unless statistics are available for particular countries, coking coal's reserves share in total proved reserves of (hard) coal is estimated assuming that it is equal to the share of coking coal in total hard coal production for each country.

Latest RMIS Dashboard update: August 2021.

### **14.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (USEIA, 2023) for 2000-2005.

Other collected/checked/registered datasets: (USEIA, 2023) (2006-2021).

Notes: Data refer to coking coal of various qualities (hard, semi-hard and semi-soft). Coal for Pulverized Coal Injection (PCI) is not included.

Latest RMIS Dashboard update: August 2023.

### **14.3 Production of refined/processed materials**

#### **14.3.1 Metallurgical coke**

Coverage: World countries.

Time period of compiled data series: 2000-2021

Reference Year: 2021.

Data source(s): (USEIA, 2023)

Other collected/checked/registered datasets: (Eurostat, 2022),(VDKI, 2022),(VDKI, 2017)

Notes: -

Latest RMIS Dashboard update: August 2023.

### **14.4 Additional information and insights about production**

- ✓ The production of hard coal by product category is derived from (WMD, 2023);
- ✓ The CAGR refers to primary (mining) production (2012-2021).

## 14.5 Applications

Geographical scope: EU.

Data source(s): JRC own calculation based on data from (Eurostat, 2022), in (Georgitzikis *et al.*, 2022).

Reference Year: 2020.

Notes: Other uses in the iron & steel industry comprise foundry coke used in ferroalloy and castings production, breeze coke in iron ore sintering, and fuel for heating and operation of coke ovens and blast furnaces.

Latest RMIS Dashboard update: August 2023.

## 14.6 Trade of primary materials

Coverage: The HS nomenclature does not provide the required granularity for distinguishing coking coal's trade flows. Data are a JRC estimation based on the following approach:

- Exports: Seaborne exports of coking coal are obtained from (Euracoal, 2022) for a number of countries (Australia, Canada, the US, Russia, China). For the rest of the non-EU producing countries, coking coal exports were approximated using WITS data for bituminous coal exports (HS 270112). Coking coal's share in bituminous coal exports was estimated under the assumption that coking coal's exports are proportional to each country's production share of coking coal in the total coal production (steam+coking coal) and taking into account domestic demand for coking coal in pig iron production in blast furnaces. For EU countries, Eurostat is the source of data (CN 27011210 'Coking coal, whether or not pulverised, non-agglomerated').

- Imports: The approximation is based on data provided by HS 270112, domestic coking coal demand for pig iron production in blast furnaces, domestic coking coal production, and coking coal exports estimated as above. For EU countries, data are sourced from Eurostat (CN 27011210 'Coking coal, whether or not pulverised, non-agglomerated').

Data source(s): JRC estimation based on (Euracoal, 2022), (WITS, 2021), (Eurostat Comext, 2022), (BGS, 2021)

Reference Year: 2019.

Notes: Volumes are converted to value with the annual average price of coking coal in 2019 (TSI, Hard Coking Coal, FOB Australia East Coast). For EU countries, the annual average exchange rate EUR/USD is employed.

Relevant Harmonized System (HS) Codes: HS 270112 *Bituminous coal, whether/not pulverised but not agglomerated*

Latest RMIS Dashboard update: August 2021.

## 14.7 Trade of refined/processed materials

The trade of metallurgical coke (blast furnace coke) made from coking coal is captured by HS 270400. However, trade data are not shown because the heading, along with metallurgical coke, includes coke and semi-coke made from various qualities of coal used in the manufacture of electrodes (generally intended for the production of ferro-alloys) and other uses than metallurgical coke.

## 14.8 End-of-Life Recycling Input Rate (EOL-RIR)

Coverage: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015)

Reference Year: 2013.

Notes: In line with the methodology described in (Peiró *et al.*, 2018), the indicator is calculated from background data provided by the source.

Latest RMIS Dashboard update: August 2021.



## 14.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **15 Copper**

### **15.1 Resources and Reserves**

#### **15.1.1 Resources**

Data source(s): (Mudd and Jowitt, 2018).

Reference Year: 2015.

Notes: The comprehensive inventory of the country-level resources is comprised of code-based (56% of the total deposits) and non-code resources (44% of the total deposits).

Other collected/checked/registered datasets: (S&P, 2022)

Latest RMIS Dashboard update: August 2021.

#### **15.1.2 Reserves**

Data source(s): (Mudd and Jowitt, 2018).

Reference Year: 2015.

Notes: The inventory of the study consists predominantly of code-based reserves (99% of the total deposits of the inventory).

Other collected/checked/registered datasets: (S&P, 2022) (USGS, 2023).

Latest RMIS Dashboard update: August 2021.

### **15.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-Cu, 2023) (2000-2019)

Notes: -

Latest RMIS Dashboard update: August 2023.

### **15.3 Production of refined/processed materials**

#### **15.3.1 Refined copper**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (USGS myb-Cu, 2023) (2000-2019).

Notes: Figures relate to both primary and secondary refined copper, whether electrolytic or fire refined. Metal recovered from secondary remelting alone is excluded. The production of Finland in 2017-2019 is compiled from (USGS myb-Cu, 2023), whereas in 2020-2021 is assumed to be equivalent to its 2019 level. Data for France, Hungary, Taiwan-SAR China, and the Republic of Congo are also based on (USGS myb-Cu, 2023).

Latest RMIS Dashboard update: August 2023.

## 15.4 Additional information and insights about production

- ✓ The mine production by product category is sourced from (ICSG, 2022);
- ✓ The refined copper production by feedstock and process is sourced from (USGS myb-Cu, 2023);
- ✓ The CAGR refers to the production of refined copper (2012-2021).

## 15.5 Applications

Geographical scope: EU28.

Data source(s): EC MSA study (Passarini *et al.*, 2018).

Reference Year: 2014.

Notes: End-use consumption in the EU (products 'used') by sector.

Latest RMIS Dashboard update: August 2021.

## 15.6 Trade of primary materials

Coverage: Trade data comprise the aggregate of HS 260300, HS 262030 and HS 740100. These headings encompass copper ores and concentrates, intermediate products of copper metallurgy (mattes and cements), and metallurgical residues containing copper from the treatment of ores or electrolytic, chemical or other processes, respectively. Copper contained as a co- or by-product in ores and concentrates of host metals (e.g. of zinc) and intermediate metallurgical products (e.g. of nickel) of other metals is not possible to be considered.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: DRC's reported trade data are sourced from (UN Comtrade, 2022). Iran's, Ukraine's and Mozambique's trade in 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 260300 *Copper ores and concentrates*; HS 262030 *Slag, ash and residues; (not from the manufacture of iron or steel), containing mainly copper*; HS 740100 *Copper mattes; cement copper (precipitated copper)*.

Latest RMIS Dashboard update: August 2021.

## 15.7 Trade of refined/processed materials

Coverage: The product aggregate representing processed and refined forms of copper consists of headings HS 282550, HS 282741, HS 283325, HS 740200, HS 740311, HS 740312, HS 740313, HS 740319, HS 740321, HS 740322, HS 740329 and HS 740500. The products covered include copper oxides, chloride oxides and chloride hydroxides of copper, sulphates of copper, unrefined copper (black copper, blister copper) and copper anodes for electrolytic refining, refined copper in various unwrought forms, unwrought brass and bronze, other unwrought copper alloys, and copper master alloys.

Data source(s): (WITS, 2021).

Reference Year: 2021.

Notes: DRC's reported trade data are sourced from (UN Comtrade, 2022). Iran's, Ukraine's and Mozambique's trade in 2019 is derived from reported imports and exports by their trade partners. Equally, the trade flows of Myanmar, Bangladesh, Cuba, DPR Korea, Tajikistan, Venezuela, Bahrain, Dominican Republic, Lebanon, Montenegro and Oman for 2019 is estimated from mirror data on the basis of reported imports/exports by their trade partners.

Relevant Harmonized System (HS) Codes:

HS 282550 *Copper oxides and hydroxides*;

HS 282741 *Chloride oxides and chloride hydroxides; of copper*;

HS 283325 *Sulphates; of copper*;

HS 740200 *Copper; unrefined, copper anodes for electrolytic refining;*  
HS 740311 *Copper; refined, unwrought, cathodes and sections of cathodes;*  
HS 740312 *Copper; refined, unwrought, wire-bars;*  
HS 740313 *Copper; refined, unwrought, billets;*  
HS 740319 *Copper; refined, unwrought, n.e.c. in item no. 7403.1;*  
HS 740321 *Copper; copper-zinc base alloys (brass) unwrought;*  
HS 740322 *Copper; copper-tin base alloys (bronze) unwrought;*  
HS 740329 *Copper; copper alloys n.e.c. in heading no. 7403 (other than master alloys of heading no. 7405);*  
HS 740500 *Copper; master alloys of copper.*  
Latest RMIS Dashboard update: August 2021.

### **15.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU28.

Data source(s): JRC calculation based on data in (ICA, 2022).

Reference Year: 2018.

Notes: Data originate from Fraunhofer Institute's dynamic copper flow model developed for the International Copper Association (ICA) (Soulier *et al.*, 2018)(Glöser *et al.*, 2013).

Latest RMIS Dashboard update: March 2022.

### **15.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 16 Diatomite

### 16.1 Resources and Reserves

Data on the resource distribution by countries are not available. World resources of diatomite are large, and there should be no shortage in the foreseeable future. Reserve data reported by the United States Geological Survey have a partial coverage across world countries (USGS, 2023) (Kogel *et al.*, 2006).

### 16.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s) : (BGS, 2023), except China (2016-2019) from (USGS myb-Diatomite, 2022).

Other collected/checked/registered datasets: (WMD, 2023) (2006-2021) (USGS myb-Diatomite, 2022) (2014-2021).

Notes: Data for Spain include tripolite. Danish production corresponds to 'moler' (an impure diatomite containing a large proportion of clay).

Latest RMIS Dashboard update: August 2023.

### 16.3 Production of refined/processed materials

No data are available for processed (calcined) diatomite.

### 16.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 16.5 Applications

Geographical scope: World.

Data source(s): (BRGM, 2020c)

Reference Year: 2017.

Notes: Robust data for the breakdown of uses in Europe are unavailable.

Latest RMIS Dashboard update: August 2023.

### 16.6 Trade of primary materials

Coverage: Trade of diatomite is captured under HS 251200. Apart from diatomite, the heading contains other siliceous earth's minerals (kieselguhr, tripolite, moler etc.).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Trade flows of Iran, Guyana, Mozambique and Ukraine's trade for 2019 are approximated from reported imports and exports by their trade partners.

Relevant Harmonized System (HS) Codes: HS 251220 *Siliceous fossil meals (e.g. kieselguhr, tripolite and diatomite) and similar siliceous earths; whether or not calcined, of an apparent specific gravity of 1 or less.*

Latest RMIS Dashboard update: August 2021.

### **16.7 Trade of refined/processed materials**

Trade of calcined diatomite recorded under HS 380290 is not considered as the HS heading contains several activated mineral products.

### **16.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No robust data are available. The EOL-RIR is assessed close to 0%.

### **16.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 17 Dysprosium

### 17.1 Resources and Reserves

No data have been compiled (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### 17.2 Production of primary materials

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and dysprosium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of dysprosium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### 17.3 Production of refined/processed materials

Information is not accessible in the public domain.

### 17.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 17.5 Applications

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data refer to dysprosium's demand by end use.

Latest RMIS Dashboard update: August 2023.

### 17.6 Trade of primary materials

There are no specific codes to dysprosium in international trade statistics (HS). Dysprosium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).

### **17.7 Trade of refined/processed materials**

There are no specific codes to dysprosium in international trade statistics (HS). Dysprosium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.6).

### **17.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2013.

Notes: The indicator is calculated from background data reported by the source in accordance with the methodology described in (Peiró *et al.*, 2018).

Latest RMIS Dashboard update: August 2021.

### **17.9 Other Indicators**

- ✓ The Import Reliance is derived from (European Commission, 2023) and refers to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).



## **18 Erbium**

### **18.1 Resources and Reserves**

No data have been collected. (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### **18.2 Production of primary materials**

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and erbium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of erbium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### **18.3 Production of refined/processed materials**

Data are not publicly available.

### **18.4 Applications**

Geographical scope: Europe

Data source(s): (Wood Mackenzie, 2022a)

Reference Year: 2021

Notes: Data concern erbium's demand by end use.

Latest RMIS Dashboard update: August 2023.

### **18.5 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **18.6 Trade of primary materials**

There are no specific codes to erbium in international trade statistics (HS). Erbium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).

## **18.7 Trade of refined/processed materials**

There are no specific codes to erbium in international trade statistics (HS). Erbium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

## **18.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU28

Data source(s): EC MSA study (BIO by Deloitte, 2015)

Reference Year: 2013

Notes: Background data provided by the source were used to calculate the indicator in accordance with the methodology described in (Peiró *et al.*, 2018)

Latest RMIS Dashboard update: August 2021.

## **18.9 Other Indicators**

- ✓ The EU sourcing (EU supply) is sourced from (SCRREEN2, 2023) and relates to all forms of erbium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **19 Europium**

### **19.1 Resources and Reserves**

No data have been gathered (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### **19.2 Production of primary materials**

Coverage: World countries (2021), World total (2000-2020)

Time period of compiled data series: 2000-2021

Reference Year: 2021

Data source(s): JRC analysis based on the total REE production and europium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of europium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### **19.3 Production of refined/processed materials**

Data are not publicly available.

### **19.4 Applications**

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data are relevant to europium's demand by end use.

Latest RMIS Dashboard update: August 2023.

### **19.5 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **19.6 Trade of primary materials**

There are no specific codes to europium in international trade statistics (HS). Europium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).

### **19.7 Trade of refined/processed materials**

There are no specific codes to europium in international trade statistics (HS). Europium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

### **19.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Consistent data for europium's EOL-RIR in the EU are missing. Data provided from the EC MSA study (BIO by Deloitte, 2015) are not taken into account as they are not consistent with supplementary sources of information (the indicator is calculated at 38% for year 2013 on the basis of available data).

### **19.9 Other Indicators**

- ✓ The EU sourcing (EU supply) originates from (SCRREEN2, 2023) and relates to all forms of europium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 20 Feldspar

### 20.1 Resources and Reserves

Feldspar reserve data have only been assessed for a few countries. Detailed estimates of world reserves and resources for most countries are not available or have not been compiled. World resources of feldspar are more than adequate for the foreseeable future. (USGS, 2023) (Kogel *et al.*, 2006).

### 20.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (WMD, 2023) (2006-2021), (USGS myb-feldspar, 2022) (2013-2019), (Dondi, 2019a) (2012-2016), (Dondi, 2018) (2016).

Notes: Data refer to the aggregated production of feldspar minerals of various grades (crude, ground etc.), and nepheline syenite. Data for Italy (2006-2021), and Poland (2014-2021) are gathered from (WMD, 2023).

Latest RMIS Dashboard update: August 2023.

### 20.3 Production of refined/processed materials

Not applicable. Marketable feldspar is not processed beyond the typical crushing, grinding and flotation techniques.

### 20.4 Additional information and insights about production

- ✓ Mine production by mineral is derived from (BGS, 2023) .
- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 20.5 Applications

Geographical scope: Europe.

Data source(s): (IMA Europe, 2018).

Reference Year: 2017.

Notes: Data concern end-use applications.

Latest RMIS Dashboard update: August 2021.

### 20.6 Trade of primary materials

Coverage: Trade data comprise feldspar (HS 252910) and feldspathoids (leucite, nepheline and nepheline syenite) (HS 252930). The HS headings employed do not include feldspathic sands.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 252910 *Feldspar* ; HS 252930 *Leucite; nepheline and nepheline syenite*

Latest RMIS Dashboard update: August 2021.

## **20.7 Trade of refined/processed materials**

Not applicable.

## **20.8 End-of-Life Recycling Input Rate (EOL-RIR)**

There is insufficient information to compute feldspar's EOL-RIR.

## **20.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 21 Fluorspar

### 21.1 Resources and Reserves

#### 21.1.1 Resources

Fluorspar resource data are not available.

#### 21.1.2 Reserves

Data source(s): (USGS, 2023)

Reference Year: 2022

Notes: Reserves are defined according to the USGS classification system (USGS, 1980)

Latest RMIS Dashboard update: August 2023.

### 21.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-fluorspar, 2022) (2012-2019)

Notes: Figures include all quality grades of fluorspar. In 2006-2021, reported data for Mexico by BGS are prioritised over WMD, after comparison with other data sources (national statistics - INEGI). Production data reported by BGS are added in the dataset for Kazakhstan and Kyrgyzstan (2006-2021).

Latest RMIS Dashboard update: August 2023.

### 21.3 Production of refined/processed materials

#### 21.3.1 Hydrofluoric acid

Coverage: World total and EU total.

Time period of compiled data series: 2015-2021 for world production and 2008-2021 for the EU production

Reference Year: 2021.

Data source(s):(Statista, 2022a) for global production, and (Eurostat Prodcom, 2023b) for the EU production.

Other collected/checked/registered datasets: -

Notes: Data on the global supply of hydrofluoric acid at country level are not available in the public domain.

Latest RMIS Dashboard update: August 2023.

#### 21.3.2 Synthetic cryolite (Na<sub>3</sub>AlF<sub>6</sub>) & Aluminium fluoride (AlF<sub>3</sub>)

Data on other refined forms of fluorspar are not available.

### 21.4 Additional information and insights about production

- ✓ Fluorspar's mine production by grade is estimated from data provided by (USGS myb-fluorspar, 2022);
- ✓ The CAGR refers to primary (mining) production (2012-2021).

## 21.5 Applications

Geographical scope: EU28.

Data source(s): Derived from the EC MSA study data (BIO by Deloitte, 2015) in (European Commission, 2017a).

Reference Year: 2012.

Notes: The shares of demand are tied to the consumption of fluorspar by manufacturing sector.

Latest RMIS Dashboard update: August 2021.

## 21.6 Trade of primary materials

Coverage: Aggregate of data from headings HS 252921 and HS 252922, which comprise metallurgical-ceramic grade and acid grade fluorspar, respectively. The aggregate excludes natural cryolite.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's and Ukraine's trade for 2019 is derived from reported imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 252921 *Fluorspar; containing by weight 97% or less of calcium fluoride*; HS 252922 *Fluorspar; containing by weight more than 97% of calcium fluoride*

Latest RMIS Dashboard update: August 2021.

## 21.7 Trade of refined/processed materials

Coverage: Aggregate of data from headings HS 281111, HS 282612, and HS 282630 covering hydrofluoric acid (HF), aluminium fluoride (AlF<sub>3</sub>) and synthetic cryolite (Na<sub>3</sub>AlF<sub>6</sub>), respectively. Fluoroacids, fluorine and other fluor compounds are excluded as downstream products (e.g. HS 280130, HS 281119).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Trade flows for Iran, Mozambique, Ukraine, Bahrain and Oman are deduced from declared trade flows by trade partners.

Relevant Harmonized System (HS) Codes: HS 281111 *Hydrogen fluoride (hydrofluoric acid)*; HS 282612 *Fluorides; of aluminium*; HS 282630 *Sodium hexafluoroaluminate (synthetic cryolite)*

Latest RMIS Dashboard update: August 2021.

## 21.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: Background data provided by the source were used to calculate the indicator in accordance with the methodology described in (Peiró *et al.*, 2018).

Latest RMIS Dashboard update: August 2021.



## **21.9 Other Indicators**

- ✓ The Import Reliance for extraction (primary materials) is sourced from (European Commission, 2023) and refers to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 22 Gadolinium

### 22.1 Resources and Reserves

No data have been collected (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### 22.2 Production of primary materials

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and gadolinium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of gadolinium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### 22.3 Production of refined/processed materials

The collected information is not publicly available.

### 22.4 Applications

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data are about gadolinium's demand by end use.

Latest RMIS Dashboard update: August 2023.

### 22.5 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 22.6 Trade of primary materials

There are no specific codes to gadolinium in international trade statistics (HS). Gadolinium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).

## **22.7 Trade of refined/processed materials**

There are no specific codes to gadolinium in international trade statistics (HS). Gadolinium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

## **22.8 End-of-Life Recycling Input Rate (EOL-RIR)**

There is shortage of robust data about gadolinium's EOL-RIR in the EU.

## **22.9 Other Indicators**

- ✓ The EU sourcing (EU supply) is provided by (SCRREEN2, 2023) and relates to all forms of gadolinium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 23 Gallium

### 23.1 Resources and Reserves

Specific data for the resources and reserves of gallium are not available. As most gallium is produced as a by-product of processing bauxite and from zinc-processing residues, the distribution of the world resources of bauxite (see 2.1) and zinc (see 26498.1) provides a rough indication where gallium mineral resources of gallium are found. However, it is reported that less than 10% of the gallium contained in bauxite and zinc resources is potentially recoverable (USGS, 2023).

### 23.2 Production of primary materials

Gallium is not extracted from one particular ore but is obtained mainly as by-product of the metallurgical processing of bauxite to alumina and from zinc metallurgy; as a consequence, production statistics on gallium extracted at the mining stage are not available.

### 23.3 Production of refined/processed materials

#### 23.3.1 Refined gallium

Coverage: World countries.

Time period of compiled data series: 2006-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2009, (Butcher and Brown, 2014) for 2010, (BGS, 2023) for 2011-2021.

Other collected/checked/registered datasets: (BGS, 2023) (2007-2010), (WMD, 2023) (2010-2021), (USGS myb-Ga, 2022) (2012-2020), (USGS, 2023) (2021), (Rongguo *et al.*, 2016) (2006-2015), (Eurostat Prodcum, 2023b) (2019-2021).

Notes: Data relate to primary crude gallium. Obtaining reliable figures for actual gallium production (primary and secondary) is challenging due to the small market and the few producing companies. The production of Hungary in 2011-2014 is sourced from (USGS myb-Ga, 2022). The production of Germany in 2011-2012 is assumed similar to its 2010 level. The production of Russia in 2011-2021, the production of China in 2020-2021 as well as the production of Ukraine in 2011-2012 are sourced from (WMD, 2023).

Latest RMIS Dashboard update: August 2023.

#### 23.3.2 High-purity refined gallium

Coverage: World total.

Time period of compiled data series: 2010-2022.

Reference Year: 2022.

Data source(s): (USGS mcs, 2023).

Other collected/checked/registered datasets: -

Notes: The availability of suitable data is limited. Figures for 2010, 2011 and 2018 are a JRC estimate (extrapolation).

Latest RMIS Dashboard update: August 2023.

### 23.4 Additional information and insights about production

- ✓ Gallium's production by host material is sourced from (Liedtke and Huy, 2018);
- ✓ The production capacities of crude gallium from primary sources are derived from (USGS, 2023) and (USGS myb-Ga, 2022);

- ✓ The production capacities of high-purity refined gallium are elaborated from data in (USGS, 2023) and (Liedtke and Huy, 2018);
- ✓ The CAGR relates to crude gallium production (2012-2021).

### **23.5 Applications**

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: Figures apply to end-use products.

Latest RMIS Dashboard update: August 2021.

### **23.6 Trade of primary materials**

Not applicable. Gallium is extracted during the refining stage of bauxite and zinc ores.

### **23.7 Trade of refined/processed materials**

Obtaining data on the worldwide trade in gallium and gallium-rich compounds is not possible using the HS nomenclature. Unwrought gallium and gallium powders are recorded in HS 811292 combined with many other metals. Similarly, gallium arsenide's trade is captured by HS 285390 together with compounds of several materials, etc.

### **23.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: The indicator is quantified from background data provided by the source in line with the methodology described in (Peiró *et al.*, 2018).

Latest RMIS Dashboard update: August 2021.

### **23.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **24 Germanium**

### **24.1 Resources and Reserves**

#### **24.1.1 Resources**

Data source(s): (Frenzel *et al.*, 2014)

Reference Year: NA

Notes: Estimate of resources based on compilation of known deposits containing germanium. The available resources of germanium are associated with certain zinc and lead-zinc-copper sulphide ores and Ge-bearing coal and flue dusts. In general, data on germanium resources are scarce because of its by-product nature.

Latest RMIS Dashboard update: August 2021.

#### **24.1.2 Reserves**

Estimates of global reserves are typically not available as the recoverable germanium content in zinc and Ge-bearing coal reserves cannot be determined.

### **24.2 Production of primary materials**

Data on germanium mine production are not readily available as it is a by-product of zinc mining; germanium is also extracted from coal ash.

### **24.3 Production of refined/processed materials**

#### **24.3.1 Refined germanium**

Coverage: World countries

Time period of compiled data series: 2006-2021

Reference Year: 2021

Data source(s): JRC compilation based on (WMD, 2023).

Other collected/checked/registered datasets: (USGS myb-Ge, 2022) (2015-2020), (Eurostat Prodcom, 2023b) (2019-2021), (Melcher and Buchholz, 2014) (2012).

Notes: Data for germanium refinery production are generally of poor quality in terms of coverage of global producers. An estimate for the production of Germany is provided from (European Commission, 2023) and it is assumed to be constant over 2006-2021. Belgium's production is estimated by JRC on the basis of wafer capacity and it is assumed to be steady over 2006-2021. Estimates for the production of Canada from 2006 to 2013 are gathered from several sources, whereas the output in 2014-2021 is assumed stable to its 2013 level.

Latest RMIS Dashboard update: August 2023.

### **24.4 Applications**

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: Figures concern end-use products.

Latest RMIS Dashboard update: August 2021.

## 24.5 Additional information and insights about production

- ✓ The CAGR relates to refinery production (2012-2021).

## 24.6 Trade of primary materials

Data are not available. Germanium is principally a by-product of zinc metallurgy and international trade statistics do not provide the required detail to identify trade of Ge-bearing raw materials. Moreover, ores and concentrates in which germanium is the principal constituent are classified under HS 261790 together with other ores and concentrates.

## 24.7 Trade of refined/processed materials

Coverage: Detailed trade data are not available in the HS nomenclature. The heading HS 282560 is used as a proxy as data do not reflect exclusively the trade of germanium oxides (e.g. GeO<sub>2</sub>). Unwrought germanium metal and other germanium compounds cannot be recorded due to the high aggregation of the related HS headings (e.g. HS 811292 for unwrought Ge, HS 282739 for GeCl<sub>4</sub>).

Data source(s): (WITS, 2021).

Reference Year: 2019

Notes: No 'mirror' trade data are utilised.

Relevant Harmonized System (HS) Codes: HS 282560 *Germanium oxides and zirconium dioxide*

Latest RMIS Dashboard update: August 2021.

## 24.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU28

Data source(s): EC MSA study (BIO by Deloitte, 2015)

Reference Year: 2012

Notes: The indicator is determined from background data reported by the source according to the methodology described in (Peiró *et al.*, 2018)

Latest RMIS Dashboard update: August 2021..

## 24.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **25 Gold**

### **25.1 Resources and Reserves**

#### **25.1.1 Resources**

Data source(s): (S&P, 2022)

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **25.1.2 Reserves**

Data source(s): (S&P, 2022)

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **25.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021

Reference Year: 2021.

Data source(s): (BGS, 2023)

Other collected/checked/registered datasets: (WMD, 2023), (WGC, 2022)

Notes: Mine production of gold. Data may not include an estimate for gold produced by artisanal and small-scale mining (ASM), which is generally informal.

Latest RMIS Dashboard update: August 2023.

### **25.3 Production of refined/processed materials**

#### **25.3.1 Refined gold**

Coverage: World total.

Time period of compiled data series: 2010-2022.

Reference Year: 2022.

Data source(s): (WGC, 2023).

Other collected/checked/registered datasets: -

Notes: Information about the breakdown of production across countries is not available. The figure represents the aggregate of annual primary (mine) and recycled gold supply.

Latest RMIS Dashboard update: August 2023.

### **25.4 Applications**

Geographical scope: Europe



Data source(s): Background data from (WGC, 2023).

Reference Year: 2022.

Notes: Data relate to final end-user demand. Investments consist of gold bar & coin. Demand from gold-backed ETFs & similar products as well as from central banks & other institutions is not included.

Latest RMIS Dashboard update: August 2023.

## 25.5 Additional information and insights about production

- ✓ Information about the main commodities extracted in the gold-producing mines is obtained from (S&P, 2023);
- ✓ Gold's refinery production per feedstock is derived from (WGC, 2023);
- ✓ The CAGR relates to the production of refined gold (2013-2022).

## 25.6 Trade of primary materials

Coverage: Data correspond to HS 261690. It is noted that PGM-bearing sands are also classified in this heading along with primary gold concentrates. The trade of gold contained as co- or by-product in ores and concentrates of other metals (e.g. Cu, Pb, Ag, Zn) cannot be determined by international trade statistics.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: No 'mirror' trade data are utilised.

Relevant Harmonized System (HS) Codes: HS 261690 *Precious metal ores and concentrates; (excluding silver)*

Latest RMIS Dashboard update: August 2021.

## 25.7 Trade of refined/processed materials

Coverage: Aggregate of HS 710811 and HS 710812 covering the various unwrought or powder forms of gold or gold alloys. Trade of colloidal gold (HS 284310) and gold amalgams (HS 284390) is not included due to the low granularity of the headings. Trade of semi-manufactured forms of gold is excluded (HS 710813).

Data source(s): (WITS, 2021)

Reference Year: 2019

Notes: Dominican's Republic's, and Mozambique's trade flows for 2019 are derived from reported imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 710811 *Metals; gold, non-monetary, powder*; HS 710812 *Metals; gold, non-monetary, unwrought (but not powder)*.

Latest RMIS Dashboard update: August 2021.

## 25.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: World

Data source(s): JRC elaboration based on background data from (WGC, 2023)

Reference Year: 2022

Notes: The indicator is approximated by the ratio of recycled gold production to total gold supply comprised of mine production, recycling production and producers' net hedging. Data on recycled gold provided by the World Gold Council concern gold recovered from fabricated products, including unused trade stocks (gold sold for cash), which is refined back into bullion. It does not include process scrap or gold traded-in for other gold products (for example, by consumers at jewellery stores). The value of the indicator is assumed to be applicable also in the EU.

Latest RMIS Dashboard update: August 2023.

## **25.9 Other Indicators**

-

## 26 Gypsum

### 26.1 Resources and Reserves

Comprehensive estimates of the distribution of world resources by country are not available. The compiled information on world reserves is also sparse. Resources and reserves of gypsum are abundant and widely distributed across the globe (USGS, 2023) (Kogel *et al.*, 2006).

### 26.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021

Reference Year: 2021.

Data source(s): (BGS, 2023)

Other collected/checked/registered datasets: (WMD, 2023) (2006-2021), (USGS myb-gypsum, 2023) (2017-2021)

Notes: Data concern the production of gypsum and anhydrite minerals. Gypsum plaster production may also be included in the reported data. The output of synthetic gypsum is excluded. The production of Kyrgyzstan, United Arab Emirates, and Somalia is obtained from (WMD, 2023).

Latest RMIS Dashboard update: August 2023.

### 26.3 Production of refined/processed materials

Not applicable. The production of calcined gypsum (plasters) is considered in primary raw materials.

### 26.4 Applications

Geographical scope: Europe.

Data source(s): Data from (Eurogypsum, 2016) in (European Commission, 2017b).

Reference Year: NA

Notes: It is assessed that data refer to end-use demand for gypsum products.

Latest RMIS Dashboard update: August 2021.

### 26.5 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 26.6 Trade of primary materials

Coverage: Trade data correspond to the product aggregate of gypsum and anhydrite (HS 252010) and plasters, i.e. calcined gypsum (HS 252020).

Data source(s): (WITS, 2021).

Reference Year: 2019

Notes: Oman's, Iran's, Guyana's, Mozambique's and Ukraine's trade data for 2019 are estimated from declared imports and exports by their trade partners.

Relevant Harmonized System (HS) Codes: HS 252010 *Gypsum; anhydrite*; HS 252020 *Plasters; (consisting of calcined gypsum or calcium sulphate), whether or not coloured, with or without small quantities of accelerators or retarders.*

Latest RMIS Dashboard update: August 2021.

### **26.7 Trade of refined/processed materials**

Not applicable. The heading HS 252020 covering plasters, i.e. gypsum partly or completely dehydrated by calcination, is allocated to primary materials.

### **26.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU

Data source(s): JRC assessment based on (Eurogypsum, 2021)

Reference Year: 2019

Notes: The indicator is roughly approximated by the quantity of recycled gypsum used in plasterboard manufacturing as reported by the source, and total primary production in 2019.

Latest RMIS Dashboard update: August 2023.

### **26.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 27 Hafnium

### 27.1 Resources and Reserves

Quantitative estimates of hafnium resources and reserves are not available. Hafnium is associated in nature with zirconium minerals e.g. zircon and baddeleyite (see 99.1 for countries having significant zirconium resources and reserves).

### 27.2 Production of primary materials

Hafnium is extracted together with zirconium and data for mined hafnium are not reported. Hafnium is recovered only as a by-product of zirconium refining (production of zirconium tetrachloride and nuclear-grade zirconium sponge metal) at a ratio of about Zr:Hf=50:1.

### 27.3 Production of refined/processed materials

#### 27.3.1 Refined hafnium and hafnium compounds

Coverage: World

Time period of compiled data series: 2015-2017

Reference Year: 2017

Data source(s): JRC elaboration based on various source such as (Alkane, 2017)(Alkane, 2018)(Alkane, 2020), which provide estimates for a few individual producers in specific years.

Other collected/checked/registered datasets: -

Notes: Up-to-date and comprehensive annual production figures for hafnium are not readily available. The compiled information provides only a general overview of hafnium production. Figures include secondary production that is presumed to take place entirely in the USA (revert scrap).

Latest RMIS Dashboard update: August 2021.

#### 27.3.2 Hafnium metal products

Coverage: EU countries.

Time period of compiled data series: 2019-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodcorn, 2023b).

Other collected/checked/registered datasets: -

Notes: Products of unwrought hafnium & hafnium powders. PRC code: 24453062 *Unwrought hafnium "celtium"; hafnium powders.*

Latest RMIS Dashboard update: August 2023.

### 27.4 Applications

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021) with data from (Alkane, 2017).

Reference Year: 2016.

Notes: Figures correspond to hafnium's end uses. According to the MSA study, the global demand shares reported by (Alkane, 2017) are representative for the use of finished products in the EU.

Latest RMIS Dashboard update: August 2021.

## 27.5 Additional information and insights about production

### 27.6 Trade of primary materials

Coverage: Hafnium is not extracted from one particular ore but is obtained as by-product of zirconium metallurgy. Therefore, data corresponding to the host primary material i.e. HS 261510 *Zirconium ores and concentrates* are used as a proxy. Disaggregated data for Hf-bearing zirconia obtained from zirconium ores and concentrates are not available (HS 282560).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Ukraine's and Mozambique's trade data are obtained from reported trade flows by trade partners.

Relevant Harmonized System (HS) Codes: HS 261510 *Zirconium ores and concentrates*.

Latest RMIS Dashboard update: August 2021.

### 27.7 Trade of refined/processed materials

No data are available for hafnium's refined/processed products. The international trade of refined hafnium compounds (e.g. hafnium oxide and hafnium tetrachloride in HS 282590 and HS 282739, respectively) and unwrought hafnium metal (HS 811292) cannot be tracked as the relevant HS headings do not have the required detail. Similarly, wrought hafnium products are reported with other materials under HS 811299.

### 27.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: The indicator is calculated from background data provided by the source in line with the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020).

Latest RMIS Dashboard update: August 2021.

### 27.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 28 Helium

### 28.1 Resources and Reserves

#### 28.1.1 Resources

Data source(s): (USGS, 2023) (Brennan *et al.*, 2021).

Reference Year: 2022.

Notes: The recoverable helium resources from known natural gas reservoirs in the US include the Federal helium inventory.

Latest RMIS Dashboard update: August 2023.

#### 28.1.2 Reserves

The presentation of the global distribution of helium reserves is not possible because insufficient baseline data are available for some natural gas-rich countries (e.g. Qatar, Iran).

### 28.2 Production of primary materials

Not applicable. Helium is a by-product recovered from natural gas extraction.

### 28.3 Production of refined/processed materials

#### 28.3.1 Helium gas

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (Elsner, 2018) for 2000-2017; (USGS mcs, 2023) for 2018-2021.

Other collected/checked/registered datasets: (USGS mcs, 2023) for 2000-2017.

Notes: Production volumes are to a great extent estimates performed by the data providers. The US output includes withdrawals from helium storage facilities. The small production levels of Germany, Ukraine and India in 2018-2021 and China in 2018-2020 are a JRC estimate based on the output of 2017.

Latest RMIS Dashboard update: August 2023.

### 28.4 Applications

Geographical scope: Western Europe.

Data source(s): IHS Markit data reported by (Elsner, 2018).

Reference Year: 2015.

Notes: Data relate to the end uses of helium. According to (Matos *et al.*, 2021), figures are also applicable in the EU

Latest RMIS Dashboard update: August 2021.

### 28.5 Additional information and insights about production

- ✓ The production capacity by process is elaborated from data in (Elsner, 2018);
- ✓ The calculation of CAGR is based on the production of helium gas from 2012 to 2021.

## **28.6 Trade of primary materials**

Not applicable.

## **28.7 Trade of refined/processed materials**

No data are available in international trade statistics (HS) as the HS nomenclature does not have the required level of detail to allow tracking of helium gas trade flows, which are reported in HS 280429 together with other rare gases.

## **28.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: The indicator is calculated from background data provided by the source according to the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020).

Latest RMIS Dashboard update: August 2021.

## **28.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023)



## **29 Heavy Rare Earth Elements (HREE)**

### **29.1 Resources and Reserves**

Information for individual rare earth elements is not available (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements).

### **29.2 Production of primary materials**

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC elaboration based on the total REE production (see 67.2)

Other collected/checked/registered datasets: -

Notes: The HREE group comprises dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium and yttrium. Figures are the aggregate of the estimated production of the each HREE.

Latest RMIS Dashboard update: August 2023.

### **29.3 Production of refined/processed materials**

#### **29.3.1 Refined HREE**

Coverage: World countries.

Time period of compiled data series: 2021.

Reference Year: 2021.

Data source(s): (Wood Mackenzie, 2022b).

Other collected/checked/registered datasets: -

Notes: Data aggregate the estimated production of refined dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium and yttrium. Recycling is included.

Latest RMIS Dashboard update: August 2023.

### **29.4 Applications**

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data show HREE demand by end use.

Latest RMIS Dashboard update: August 2023.

### **29.5 Additional information and insights about production**

- ✓ The repartition of mine production by REE group is a JRC elaboration;
- ✓ The breakdown of refined HREE production by source is derived from (Wood Mackenzie, 2022b);
- ✓ The CAGR refers to primary (mining) production from 2012 to 2021.

## **29.6 Trade of primary materials**

Data are not available in the HS nomenclature (See section 67.6).

## **29.7 Trade of refined/processed materials**

Data are not available in the HS nomenclature (See section 67.7)

## **29.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Available data are insufficient for the calculation or estimation of the EOL-RIR in the EU. The EOL-RIR worldwide is estimated to be 14% in 2021 (as the share of EOL recycling in global supply) based on data from (Wood Mackenzie, 2022a); however, it is assessed that the figure for the indicator is not appropriate for the EU.

## **29.9 Other Indicators**

- ✓ The Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **30 Holmium**

### **30.1 Resources and Reserves**

No data are available. No data have been compiled (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### **30.2 Production of primary materials**

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and holmium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of holmium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### **30.3 Production of refined/processed materials**

The gathered information is not publicly available.

### **30.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **30.5 Applications**

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data relate to holmium's demand by end use.

Latest RMIS Dashboard update: August 2023.

### **30.6 Trade of primary materials**

There are no specific codes to holmium in international trade statistics (HS). Its trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).

### **30.7 Trade of refined/processed materials**

There are no specific codes to holmium in international trade statistics (HS). Their trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

### **30.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Data to calculate or estimate holmium's EOL-RIR in the EU are missing.

### **30.9 Other Indicators**

- ✓ The EU sourcing (EU supply) is sourced from (SCREEN2, 2023) and relates to all forms of holmium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used are provided by (SCREEN2, 2023).

## **31 Hydrogen**

### **31.1 Resources and Reserves**

#### **31.1.1 Resources**

No data are available.

#### **31.1.2 Reserves**

Data source(s): JRC estimate based on (BP, 2022)

Reference Year: 2020

Notes: The country distribution for proved reserves of each of the fossil fuels (natural gas, coal and oil) from which 99.3% of hydrogen production was derived in 2021, was weighted with the hydrogen production mix in 2021 by fossil fuel reported by (IEA, 2022a) (natural gas: 62%, coal=19%; oil=18.7%).

Latest RMIS Dashboard update: August 2023.

### **31.2 Production of primary materials**

Not applicable. The production of fossil fuels (natural gas, coal, oil), from which hydrogen is almost entirely produced, is not considered.

### **31.3 Production of refined/processed materials**

#### **31.3.1 Hydrogen gas**

Coverage: World total, EU total.

Time period of compiled data series: 2020-2021.

Reference Year: 2021.

Data source(s): (IEA, 2022a), (FCHO, 2022), (Hydrogen Europe, 2022), (HyARC, 2016)

Other collected/checked/registered datasets: -

Notes: Hydrogen production volumes are not available in long time series. The total production in 2021 is collected from (IEA, 2022a). It includes pure hydrogen production and hydrogen with carbon-containing gases in methanol production and steel manufacturing. It excludes by-product hydrogen from the chlor-alkali industry, and hydrogen present in residual gases from industrial processes used for heat and electricity generation. The top EU producers are derived from (HyARC, 2016), (FCHO, 2022) and (Hydrogen Europe, 2022). The EU share in global refined production refers to 2020, and it is estimated on the basis of data provided by (FCHO, 2022) and (IEA, 2022a).

Latest RMIS Dashboard update: August 2023.

### **31.4 Applications**

Geographical scope: Europe.

Data source(s): (WITS, 2021).

Reference Year: 2020.

Notes: Data reflect the end uses of hydrogen in the European Union, the European Free Trade Association (EFTA), and the United Kingdom.

Latest RMIS Dashboard update: August 2023.

### **31.5 Additional information and insights about production**

- ✓ The total production capacity (captive & merchant) in 2016 is derived from (HyARC, 2016);
- ✓ Total hydrogen's production by technology is sourced from (IEA, 2022a);
- ✓ The distribution of low-carbon hydrogen capacity (for all uses) by country is elaborated from (IEA, 2022b);
- ✓ The distribution of low-carbon hydrogen capacity (for all uses) by technology is derived from (IEA, 2022b);
- ✓ Country-specific capacity data in 2016 are used as a proxy for the calculation of the HHI index of refined production.

### **31.6 Trade of primary materials**

Not applicable. Trade of fossil fuels is not considered.

### **31.7 Trade of refined/processed materials**

Coverage: Data for hydrogen gas are associated with heading HS 280410.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes:

Relevant Harmonized System (HS) Codes: HS 280410 *Hydrogen*.

Latest RMIS Dashboard update: August 2021.

### **31.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No data are available for the calculation or estimation of hydrogen's EOL-RIR. According to expert judgment in (European Commission, 2020a), the EOL-RIR of hydrogen is deduced to be 0%.

### **31.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. The figures for the extraction stage of both indicators relate to natural gas. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **32 Indium**

### **32.1 Resources and Reserves**

#### **32.1.1 Resources**

Data source(s): JRC elaboration based on (Werner *et al.*, 2017).

Reference Year: 2015.

Notes: Indium in zinc, copper, lead, tin and silver deposits. Calculations are based on the reported deposit tonnage and indium grades or the grade of base metals from which indium grades could be inferred.

Latest RMIS Dashboard update: August 2021.

#### **32.1.2 Reserves**

Data source(s): JRC indicative estimate based on (USGS, 2008) and (USGS, 2021).

Reference Year: 2021.

Notes: Based on indium reserves reported in 2007 (the most recent available USGS estimate of indium reserves) and a proportional allocation to 2021 based on the increase of zinc reserves between 2007 and 2021. Indium reserves associated with copper and other than zinc deposits are not accounted for.

Latest RMIS Dashboard update: August 2023.

### **32.2 Production of primary materials**

Indium is principally produced through the extraction and processing of zinc ores. There is scarce information about indium's mine production due to its by-product nature.

### **32.3 Production of refined/processed materials**

#### **32.3.1 Refined indium**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2013-2021, (USGS myb-In, 2023) for 2000-2012.

Other collected/checked/registered datasets: (BGS, 2023) for 2006-2021, (USGS myb-In, 2023) for 2013-2021.

Notes: Indium is mostly recovered as a by-product of zinc metal production. The dataset includes the production of refined indium from primary and secondary feed.

Latest RMIS Dashboard update: August 2023.

### **32.4 Applications**

Geographical scope: World.

Data source(s): (Willis *et al.*, 2012), (Lokanc *et al.*, 2015).

Reference Year: 2011.

Notes: Figures show the distribution of indium's demand by end use.

Latest RMIS Dashboard update: August 2021.

### **32.5 Additional information and insights about production**

- ✓ The CAGR refers to refinery production from 2012 to 2021.

### **32.6 Trade of primary materials**

The trade of indium's primary materials cannot be outlined by international statistics. Indium is not mined directly from one particular ore, but is instead recovered mostly as by-product of zinc metallurgy. The HS nomenclature does not provide the required detail for the zinc ores, concentrates and residues containing indium (HS 260800, HS 262019).

### **32.7 Trade of refined/processed materials**

No data can be extracted from international statistics for refined/processed indium. The HS nomenclature does not offer the adequate disaggregation for unwrought indium and indium powders; the relevant HS heading (HS 811292) contains several metals.

### **32.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: The indicator is calculated from background data provided by the source according to the methodology described in (Peiró *et al.*, 2018).

Latest RMIS Dashboard update: August 2021.

### **32.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).



## **33 Industrial Diamonds**

### **33.1 Resources and Reserves**

#### **33.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: Data refer to natural diamonds (gemstones & industrial). The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update:

#### **33.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: Data refer to natural diamonds (gemstones & industrial). The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **33.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source: (WMD, 2023) in 2006-2021, (USGS myb-diamond(industrial), 2023) for 2000-2005

Other data sources checked and/or compiled: (USGS myb-diamond(industrial), 2023) (2006-2021)

Notes: Data relate to natural industrial diamonds; synthetic are excluded.

Latest RMIS Dashboard update: August 2023.

### **33.3 Production of refined/processed materials**

Not applicable.

### **33.4 Additional information and insights about production**

- ✓ The mine production of natural diamonds by product category is elaborated from (WMD, 2023);
- ✓ The CAGR refers to primary (mining) production of industrial diamonds (2012-2021).

### **33.5 Applications**

Quantitative data on the consumption of industrial diamonds by application(e.g. in cutting and drilling tools, abrasives) or by sector (e.g. machinery, drillings, construction) are not available.

### **33.6 Trade of primary materials**

Coverage: The trade of diamond bort and stone (HS 710221) is considered.

Data source(s): (WITS, 2023).

Reference Year: 2021.

Notes: Export flows from Angola are disregarded as they are consistently reported under a different code (HS 720231) by its major trade partners i.e. as non-industrial diamonds (gemstones).

Relevant Harmonized System (HS) Codes: HS 710221 *Diamonds; industrial, unworked or simply sawn, cleaved or bruted, but not mounted or set.*

### **33.7 Trade of refined/processed materials**

Coverage: The trade of worked industrial diamonds (HS 71029) and diamond dust and powders (HS 710510) is considered; the latter code contains synthetic diamonds along with natural.

Data source(s): (WITS, 2023).

Reference Year: 2021.

Notes: -

Relevant Harmonized System (HS) Codes: HS 710229 *Diamonds; industrial, (other than unworked or simply sawn, cleaved or bruted), but not mounted or set;* HS 710510 *Stones; precious and semi-precious, dust and powder, of diamonds.*

### **33.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No information is available to calculate the EOL-RIR in the EU.

### **33.9 Other Indicators**

- ✓ Industrial diamonds were not assessed in the 2023 EU assessment of Critical raw materials (European Commission, 2023); therefore, no figures are displayed for the EU sourcing (EU supply) and Import Reliance.

## **34 Industrial Roundwood**

### **34.1 Resources and Reserves**

#### **34.1.1 Resources**

Data source(s): (FAO, 2020b).

Reference Year: 2020.

Notes: The total forest area worldwide is presumed to represent roughly resources. The dataset is adjusted by excluding the area of rubber, mangrove and cork forests.

Latest RMIS Dashboard update: August 2023.

#### **34.1.2 Reserves**

Data source(s): (FAO, 2020b).

Reference Year: 2020.

Notes: The forest area worldwide managed primarily for production (of wood and non-wood forest products) is considered a proxy for reserves. Forests designated for multiple uses, which often includes production, are not included. Forest areas of rubber and cork are subtracted from the dataset. Reporting countries in the background data represent 93% of the total forest area.

Latest RMIS Dashboard update: August 2023.

### **34.2 Production of primary materials**

Coverage: World countries.

Data source(s): (FAOSTAT, 2023a).

Reference Year: 2021.

Time period of compiled data series: 2000-2021.

Other collected/checked/registered datasets: -

Notes: Data comprise the aggregate of production of sawlogs and veneer logs (coniferous & non-coniferous), pulpwood (coniferous & non-coniferous), and other industrial roundwood (coniferous & non-coniferous).

Latest RMIS Dashboard update: August 2023.

### **34.3 Production of refined/processed materials**

#### **34.3.1 Sawwood, Wood-based panels, Veneer sheets & Wood Pulp**

Coverage: World countries.

Data source(s): JRC elaboration based on (FAOSTAT, 2023a).

Reference Year: 2021.

Time period of compiled data series: 2000-2021.

Other collected/checked/registered datasets:

Notes: Sawwood, wood-based panels, veneer sheets and paper & paperboard are considered as the processed forms of industrial roundwood. Data were harmonised to m<sup>3</sup>swe (cubic metres of solid wood equivalent, a unit that corresponds with the wood fibre contained in the product and the roundwood equivalent volume needed to produce the product when there are no losses or wood residues) using the following generic conversion factors in accordance with (UNECE/FAO, 2010): 1 m<sup>3</sup> of Sawwood=1.05; 1 m<sup>3</sup> of veneer sheets=1.08; wood-based panels=1.50; 1 t of wood pulp=2.50 m<sup>3</sup> of swe.

Latest RMIS Dashboard update: August 2023..

### **34.3.2 Sawnwood**

Coverage: World countries.

Data source(s): (FAOSTAT, 2023a).

Reference Year: 2021.

Time period of compiled data series: 2000-2021.

Other collected/checked/registered datasets: -

Notes: -

Latest RMIS Dashboard update: August 2023.

### **34.3.3 Wood-based panels**

Coverage: World countries.

Data source(s): (FAOSTAT, 2023a).

Reference Year: 2021.

Time period of compiled data series: 2000-2021.

Other collected/checked/registered datasets: -

Notes: -

Latest RMIS Dashboard update: August 2023.

### **34.3.4 Veneer sheets**

Coverage: World countries.

Data source(s): (FAOSTAT, 2023a).

Reference Year: 2021.

Time period of compiled data series: 2000-2021.

Other collected/checked/registered datasets: -

Notes: -

Latest RMIS Dashboard update: August 2023.

### **34.3.5 Wood Pulp**

Coverage: World countries.

Data source(s): (FAOSTAT, 2023a).

Reference Year: 2021.

Time period of compiled data series: 2000-2021

Other collected/checked/registered datasets: -

Notes: -

Latest RMIS Dashboard update: August 2023.

## **34.4 Additional information and insights about production**

- ✓ The removals of roundwood by type of wood are obtained from (Eurostat, 2023);
- ✓ The removals of industrial roundwood by assortment are sourced from (Eurostat, 2023);

- ✓ The CAGR refers to primary production (extraction) (2012-2021).

### 34.5 Applications

Geographical scope: EU.

Data source(s): JRC elaboration based on (Cazzaniga *et al.*, 2021).

Reference Year: 2017.

Notes: Data show the distribution of wood resource consumption by processed products. Recovered paper is not included in the balance.

Latest RMIS Dashboard update: August 2023.

### 34.6 Trade of primary materials

Coverage: The aggregate of all 'wood-in-the-rough' products (excluding fuelwood) represents the trade of industrial roundwood), i.e. HS 440311; HS 440312; HS 440321; HS 440322; HS 440323; HS 440324; HS 440325; HS 440326; HS 440341; HS 440391; HS 440393; HS 440394; HS 440395; HS 440396; HS 440397; HS 440398; HS 440399; HS 440410; HS 440420.

Data source(s): (WITS, 2023).

Reference Year: 2021.

Notes: -

Relevant Harmonized System (HS) Codes:

HS 440311 *Wood; coniferous species, in the rough, whether or not stripped of bark or sapwood, or roughly squared; treated with paint, stains, creosote or other preservatives;*

HS 440312 *Wood; non-coniferous species, in the rough, whether or not stripped of bark or sapwood, or roughly squared; treated with paint, stains, creosote or other preservatives;*

HS 440321 *Wood; coniferous species, of pine (Pinus spp.), in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, of which any cross-sectional dimension is 15 cm or more;*

HS 440322 *Wood; coniferous species, of pine (Pinus spp.), in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, of which any cross-sectional dimension is less than 15 cm;*

HS 440323 *Wood; coniferous species, of fir (Abies spp.) and spruce (Picea spp.), in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, of which any cross-sectional dimension is 15 cm or more;*

HS 440324 *Wood; coniferous species, of fir (Abies spp.) and spruce (Picea spp.), in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, of which any cross-sectional dimension is less than 15 cm;*

HS 440325 *Wood; coniferous species n.e.c in headings 4403.21 or 4403.23, in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, of which any cross-sectional dimension is 15 cm or more;*

HS 440326 *Wood; coniferous species n.e.c in headings 4403.22 or 4403.24, in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, of which any cross-sectional dimension is less than 15 cm;*

HS 440341 *Wood, tropical; as specified in Subheading Note 2 to this Chapter, dark red meranti, light red meranti and meranti bakau, in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated;*

HS 440349 *Wood, tropical; other than dark red meranti, light red meranti and meranti bakau, in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated;*

HS 440391 *Wood; oak, in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated;*

HS 440393 *Wood; of beech (Fagus spp.), in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, of which any cross-sectional dimension is 15 cm or more;*

HS 440394 *Wood; of beech (Fagus spp.), in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, of which any cross-sectional dimension is less than 15 cm;*

HS 440395 Wood; of birch (*Betula spp.*), in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, of which any cross-sectional dimension is 15 cm or more;

HS 440396 Wood; of birch (*Betula spp.*), in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, of which any cross-sectional dimension is less than 15 cm;

HS 440397 Wood; of poplar and aspen (*Populus spp.*), in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated;

HS 440398 Wood; of eucalyptus (*Eucalyptus spp.*), in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated;

HS 440399 Wood; in the rough, whether or not stripped of bark or sapwood, or roughly squared, untreated, n.e.c. in heading no. 4403;

HS 440410 Wood; coniferous, split poles, piles, pickets, stakes, pointed but not sawn lengthwise; sticks for umbrellas, tool handles etc, roughly trimmed but not turned or bent; chipwood etc, hoopwood;

HS 440420 Wood; non-coniferous, split poles, piles, pickets, stakes, pointed but not sawn lengthwise; sticks for umbrellas, tool handles etc, roughly trimmed but not turned or bent; chipwood etc, hoopwood.

Latest RMIS Dashboard update: August 2023.

### **34.7 Trade of refined/processed materials**

Coverage: The trade of processed products of industrial roundwood is derived from the aggregate of trade codes relating to sawnwood, veneer sheets, wood-based panels, and wood pulp. Tropical timber is included.

Data source(s): (WITS, 2023).

Reference Year: 2021.

Notes: -

Relevant Harmonized System (HS) Codes:

HS 440500 Wood; wood wool and wood flour;

HS 440611 Wood; railway or tramway sleepers (cross-ties), not impregnated, coniferous;

HS 440612 Wood; railway or tramway sleepers (cross-ties), not impregnated, non-coniferous;

HS 440691 Wood; railway or tramway sleepers (cross-ties), impregnated, coniferous;

HS 440692 Wood; railway or tramway sleepers (cross-ties), impregnated, non-coniferous;

HS 440712 Wood; coniferous species, of fir (*Abies spp.*) and spruce (*Picea spp.*), sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or finger-jointed, of a thickness exceeding 6mm;

HS 440719 Wood; coniferous species, other than of pine (*Pinus spp.*) or fir (*Abies spp.*) or spruce (*Picea spp.*), sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or finger-jointed, of a thickness exceeding 6mm;

HS 440721 Wood, tropical; as specified in Subheading Note 2 to this Chapter, mahogany (*Swietenia spp.*), sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm;

HS 440722 Wood, tropical; virola, imbuia and balsa, sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm;

HS 440725 Wood, tropical; dark red meranti, light red meranti and meranti bakau, sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm;

HS 440726 Wood, tropical; white lauan, white meranti, white seraya, yellow meranti and alan, sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm;

HS 440728 Wood, tropical; iroko, sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm;

HS 440729 Wood, tropical, n.e.c. in item no. 4407.2, sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, of a thickness exceeding 6mm;

HS 440791 Wood; oak (*Quercus spp.*), sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm;

HS 440792 Wood; beech (*Fagus spp.*), sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm;

HS 440793 Wood; maple (*Acer spp.*), sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm;

HS 440794 Wood; cherry (*Prunus spp.*), sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm;

HS 440795 Wood; ash (*Fraxinus spp.*), sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm;

HS 440796 Wood; of birch (*Betula spp.*), sawn or chipped lengthwise, sliced or peeled, of a thickness exceeding 6mm, whether or not planed, sanded or finger-jointed;

HS 440797 Wood; of poplar and aspen (*Populus spp.*), sawn or chipped lengthwise, sliced or peeled, of a thickness exceeding 6mm, whether or not planed, sanded or finger-jointed;

HS 440799 Wood; sawn or chipped lengthwise, sliced or peeled, of a thickness exceeding 6mm, whether or not planed, sanded or finger-jointed, n.e.c. in heading no. 4407;

HS 440810 Wood; coniferous, sheets for veneering (including those obtained by slicing laminated wood), for plywood or similar laminated wood and other wood, sawn lengthwise, sliced or peeled, planed or not, sanded, spliced or end-jointed, not over 6 mm thick;

HS 440831 Wood, tropical; as specified in Subheading Note 2 to this Chapter, dark red meranti, light red meranti, meranti bakau, sheets for veneer, plywood or other wood, sawn lengthwise, sliced or peeled, planed or not, sanded or end-jointed, not thicker than 6mm;

HS 440839 Wood, of tropical wood; as in Subheading note 2 to this Chapter, n.e.c. in heading no. 4408.31, sheets for veneer or plywood, other wood sawn length wise, sliced or peeled, whether or not planed, sanded or end-jointed, not thicker than 6mm;

HS 440890 Wood; n.e.c. in heading no. 4408, sheets for veneer or plywood, other wood sawn lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, not exceeding 6mm in thickness;

HS 440910 Wood; coniferous (including unassembled strips and friezes for parquet flooring), continuously shaped along any edges, ends or faces, whether or not planed, sanded or end-jointed;

HS 440921 Wood; bamboo (including unassembled strips and friezes for parquet flooring), continuously shaped along any edges, ends or faces, whether or not planed, sanded or end-jointed;

HS 440922 Wood; tropical (including unassembled strips and friezes for parquet flooring), continuously shaped along any edges, ends or faces, whether or not planed, sanded or end-jointed;

HS 440929 Wood; non-coniferous, other than bamboo or tropical wood, (including unassembled strips and friezes for parquet flooring), continuously shaped along any edges, ends or faces, whether or not planed, sanded or end-jointed;

HS 441011 Particle board of wood, whether or not agglomerated with resins or other organic binding substances;

HS 441012 Oriented strand board (OSB) of wood, whether or not agglomerated with resins or other organic binding substances;

HS 441019 Wafer board and similar board of wood n.e.c. in item no. 4410.1, whether or not agglomerated with resins or other organic binding substances;

HS 441090 Particle board, oriented strand board (OSB) and similar board of ligneous materials other than wood, whether or not agglomerated with resins or other organic binding substances;

HS 441112 Medium density fibreboard (MDF), of a thickness not exceeding 5 mm;

HS 441113 Medium density fibreboard (MDF), of a thickness exceeding 5 mm but not exceeding 9 mm;

HS 441114 Medium density fibreboard (MDF), of a thickness exceeding 9 mm;

HS 441192 Fibreboard (other than MDF) of a density exceeding 0.8g/cm<sup>3</sup>, of wood or other ligneous materials, bonded or not with resins or other organic substances;

HS 441193 Fibreboard (other than MDF) of a density exceeding 0.5g/cm<sup>3</sup> but not 0.8g/cm<sup>3</sup>, of wood or other ligneous materials, bonded or not with resins or other organic substances;

HS 441194 Fibreboard (other than MDF) of a density not exceeding 0.5g/cm<sup>3</sup>, of wood or other ligneous materials, bonded or not with resins or other organic substances;

HS 441210 *Plywood, veneered panels and similar laminated wood; of bamboo;*

HS 441231 *Plywood; consisting only of sheets of wood (not bamboo), each ply 6mm or thinner, with at least one outer ply of tropical wood;*

HS 441233 *Plywood; with sheets of wood only; not bamboo; each ply 6mm or less, with at least one outer ply of alder, ash, beech, birch, cherry, chestnut, elm, eucalyptus, hickory, horse chestnut, lime, maple, oak, plane, poplar, aspen, robinia, tulipwood or walnut;*

HS 441234 *Plywood; consisting only of sheets of wood (not bamboo), each ply 6mm or thinner, with at least one outer ply of non-coniferous wood not listed in subheading 4412.33;*

HS 441239 *Plywood; consisting only of sheets of wood (not bamboo), each ply 6mm or thinner, with both outer plies of coniferous wood;*

HS 441294 *Blockboard, laminboard and battenboard (not bamboo, and other than plywood consisting only of sheets of wood each ply 6mm or thinner);*

HS 441299 *Plywood, veneered panels and similar laminated wood (other than blockboard, laminboard and battenboard, other than of bamboo, and other than plywood consisting only of sheets of wood each ply 6mm or thinner);*

HS 441300 *Wood; densified wood, in blocks, plates, strips or profile shapes;*

HS 470200 *Chemical wood pulp, dissolving grades;*

HS 470311 *Chemical wood pulp, soda/sulphate, other than dissolving grades, unbleached, coniferous;*

HS 470321 *Chemical wood pulp, soda/sulphate, other than dissolving grades, semi-bleached/bleached, coniferous;*

HS 470329 *Chemical wood pulp, soda/sulphate, other than dissolving grades, semi-bleached/bleached, non-coniferous;*

HS 470411 *Chemical wood pulp, sulphite, other than dissolving grades, unbleached, coniferous;*

HS 470419 *Chemical wood pulp, sulphite, other than dissolving grades, unbleached, non-coniferous;*

HS 470421 *Chemical wood pulp, sulphite, other than dissolving grades, semi-bleached/bleached, coniferous;*

HS 470429 *Chemical wood pulp, sulphite, other than dissolving grades, semi-bleached/bleached, non-coniferous;*

HS 470500 *Wood pulp obt. by a combination of mechanical & chemical pulping processes;*

HS 470610 *Cotton linters pulp;*

HS 470620 *Pulps of fibres derived from recovered (waste & scrap) paper/paperboard;*

HS 470630 *Pulps of fibres derived from recovered (waste & scrap) paper/paperboard/of other cellulosic material, of bamboo.*

Latest RMIS Dashboard update: August 2023.

### **34.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU.

Data source(s): JRC elaboration based on data from (FAOSTAT, 2023a).

Reference Year: 2021.

Notes: The calculation is based on recovered paper & post-consumer wood production divided by the total supply (industrial roundwood production plus recovered paper & post-consumer wood production). Data for recovered paper & post-consumer wood were converted to m<sup>3</sup> of swe (1 t of post-consumer wood=2.40 swe, 1 t of recovered paper = 3.60 m<sup>3</sup> of swe). It is assumed that post-consumer wood production is not destined for heat & power applications.

Latest RMIS Dashboard update: August 2023.



### **34.9 Other Indicators**

- ✓ The Import Reliance for extraction (primary materials) is sourced from (European Commission, 2023). The indicator relates to the material '*Roundwood*' and refers to the average 2016-2020.

## **35 Iridium**

### **35.1 Resources and Reserves**

#### **35.1.1 Resources**

Data source(s): JRC assessment based on background data from (Mudd *et al.*, 2018) and (Heraeus - SFA Oxford, 2020).

Reference Year: 2015.

Notes: -

Latest RMIS Dashboard update: August 2021.

#### **35.1.2 Reserves**

Data source(s): JRC assessment based on background data from (Mudd *et al.*, 2018) and (Heraeus - SFA Oxford, 2020).

Reference Year: 2015.

Notes: -

Latest RMIS Dashboard update: August 2021.

### **35.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (USGS myb-PGM, 2023) for 2014-2021, JRC estimate for 2000-2013.

Other collected/checked/registered datasets: -

Notes: The assessment of production in 2000-2013 is based on production data from (BGS, 2023) for 'Other than Pt and Pd platinum-group metals', rhodium production from (WMD, 2023) and (JM, 2019a), osmium production from (Girolami, 2012), and Johnson Matthey's background data for ruthenium and iridium annual demand. To achieve the split between ruthenium and iridium primary production in 2000-2013, it is assumed that their yearly output was proportional to annual demand. Osmium production is considered steady each year. Production figures refer to where the initial mining took place rather than the location of subsequent refining.

Latest RMIS Dashboard update: August 2023.

### **35.3 Production of refined/processed materials**

Data are not available for secondary supply; therefore, the total annual supply (as a proxy of production) cannot be determined.

### **35.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **35.5 Applications**

Geographical scope: World.

Data source(s): (BRGM, 2020a), data from SFA Oxford.

Reference Year: 2019

Notes: Data demonstrate end-use demand by industrial segment. Information on the European or the EU demand is not available. It is assumed that the global distribution is also applicable to the EU.

Latest RMIS Dashboard update: August 2021.

### **35.6 Trade of primary materials**

The HS nomenclature does not provide the required detail for tracing the trade of PGM-bearing ores and concentrates in HS 261690; the code is entirely assigned to gold ores and concentrates in RMIS database.

### **35.7 Trade of refined/processed materials**

Coverage: Trade data pertain to HS 711041 covering not only iridium and its alloys (unwrought and powders), but also ruthenium (and osmium). The trade of iridium compounds (HS 284390) is not included as compounds of other metals are also classified within the heading. Semi-manufactured forms of iridium are not taken into account.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes:

Relevant Harmonized System (HS) Codes: to HS 711041 Metals; iridium, osmium, ruthenium, unwrought or in powder form.

Latest RMIS Dashboard update: August 2021.

### **35.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: World.

Data source(s): JRC estimate based on (UNEP, 2011).

Reference Year: NA

Notes: Available data for the calculation of iridium's EOL-RIR are insufficient. A rough estimate for the EOL-RIR is 16% (ranging from 12% to 20%), derived according with the guidance provided in the methodology for establishing the EU List of Critical Raw Materials (Blengini *et al.*, 2017) and data from (UNEP, 2011). The estimated EOL-RIR is obtained from the median recycled content (RC) and the median old scrap ratio (OSR) of the ranges reported by (UNEP, 2011) (80-100% for the OSR and 15-20% for the RC). The derived value of the indicator is expected to be applicable also in the EU.

Latest RMIS Dashboard update: August 2021.

### **35.9 Other Indicators**

- ✓ The Import Reliance for extraction (primary materials) is assumed 100% as there is no mine production in the EU. The EU sourcing (EU supply) for the extraction stage (primary materials) is derived from (SCRREEN2, 2023) and (European Commission, 2023). It represents the average global supply in 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **36 Iron & Steel**

### **36.1 Resources and Reserves**

#### **36.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **36.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **36.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (WMD, 2023) (2000-2021), (WorldSteel, 2018) (2000-2017), (WorldSteel, 2022b) (2000-2021).

Notes: Data from (WorldSteel, 2018) for 2000-2017, and (WorldSteel, 2022b) for 2018-2020 are used for China, where the Chinese production is adjusted so that the Fe content of iron ore is comparable to world average.

Latest RMIS Dashboard update: August 2023.

### **36.3 Production of refined/processed materials**

#### **36.3.1 Pig iron**

Coverage: World countries.

Time period of compiled data series: 2000-2022.

Reference Year: 2022.

Data source(s): (WorldSteel, 2018) for years 2000-2017, (WorldSteel, 2023b) for years 2018-2022.

Other collected/checked/registered datasets: (BGS, 2023) (2000-2021, includ. Direct reduced iron).

Notes: Data comprise pig iron for steelmaking and foundry iron and all qualities (carbon, stainless, and other alloy).

Latest RMIS Dashboard update: August 2023.

#### **36.3.2 Direct Reduced Iron (DRI)**

Coverage: World countries.

Time period of compiled data series: 2000-2022.

Reference Year: 2022.

Data source(s): (WorldSteel, 2018) for years 2000-2017, (WorldSteel, 2023b) for years 2018-2022

Other collected/checked/registered datasets: -

Notes:

Latest RMIS Dashboard update: August 2023.

### **36.3.3 Crude steel**

Coverage: World countries.

Time period of compiled data series: 2000-2022.

Reference Year: 2022.

Data source(s): (WorldSteel, 2023a) for 2018-2022, (WorldSteel, 2022a) for 2017, (BGS, 2023) for 2000-2016.

Other collected/checked/registered datasets: (BGS, 2023) (2017-2021).

Notes: The output of crude steel includes production from scrap. Data include all qualities (carbon, stainless, and other alloy).

Latest RMIS Dashboard update: August 2023.

### **36.3.4 Stainless steel & heat-resisting steel**

Coverage: World countries.

Time period of compiled data series: 2011-2021.

Reference Year: 2021.

Data source(s): JRC elaboration based on (ISSF, 2018) for 2011, (WorldStainless, 2020) for 2012-2014, (WorldStainless, 2023) for 2015-2021.

Other collected/checked/registered datasets: -

Notes: Several assumptions and estimates are applied in order to cover gaps in data coverage. The aggregated production of Sweden, United Kingdom and Finland in 2016-2021 is estimated on the basis of reported data in 2011-2014. The reported production of Belgium/Austria in 2016-2021 is allocated entirely to Belgium. The production of Brazil, South Korea, Indonesia, South Africa and Russia in 2021 is estimated from the reported production in 2011-2020.

Latest RMIS Dashboard update: August 2023.

## **36.4 Additional information and insights about production**

- ✓ Iron ore's EU production by product category is estimated from (Eurostat Prodcom, 2023a);
- ✓ The production of crude steel in the EU by process is obtained from (Eurofer, 2022);
- ✓ The production of crude steel in the EU by quality is sourced from (Eurofer, 2022);
- ✓ The calculation of CAGR is based on crude steel production (2013-2022).

## **36.5 Applications**

Geographical scope: EU.

Data source(s): (Eurofer, 2022).

Reference Year: 2021.

Notes: The distribution of demand corresponds to finished steel demand per end-use sector.

Latest RMIS Dashboard update: August 2023.

### 36.6 Trade of primary materials

Coverage: Aggregate of trade flows in headings HS 260111 and HS 260112, which cover the trade of iron ore (hematite, limonite, magnetite, siderite, manganese iron ore) in coarse form and the trade of pellets, briquettes and sinter of iron ore, respectively.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Oman's, Bahrain's, Sierra Leone's, Iran's, Mozambique's and Ukraine's trade is derived from declared imports and exports by reporting partners. Also exports of producers that do not report in international trade statistics are derived with the same approach of 'mirror exports' i.e. Algeria, Bolivia, Bosnia Herzegovina, Colombia, Lao People's Dem. Rep., Liberia, Venezuela.

Relevant Harmonized System (HS) Codes: HS 260111 *Iron ores and concentrates; non-agglomerated*; HS 260112 *Iron ores and concentrates; agglomerated (excluding roasted iron pyrites)*.

Latest RMIS Dashboard update: August 2021

### 36.7 Trade of refined/processed materials

Coverage: Aggregate of HS headings comprising pig iron, direct reduced iron, sponge iron, powders and crude steel (non-alloy steel, alloy steel, stainless steel). Downstream finished steel products are excluded (long, flat).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Mozambique's, Iran's, Guyana's, and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes:

HS 720110 *Iron; non-alloy pig iron containing by weight 0.5% or less of phosphorus, in pigs, blocks or other primary forms*;

HS 720120 *Iron; non-alloy pig iron containing by weight more than 0.5% of phosphorus, in pigs, blocks or other primary forms*;

HS 720150 *Iron; alloy pig iron, spiegeleisen, in pigs, blocks or other primary forms*;

HS 720310 *Ferrous products; obtained by direct reduction of iron ore, in lumps, pellets or similar forms*;

HS 720390 *Ferrous products; spongy ferrous products and iron having a minimum purity by weight of 99.94%, in lumps, pellets or similar forms*;

HS 720510 *Iron or steel, pig iron, spiegeleisen; granules thereof*;

HS 720521 *Alloy steel powders*;

HS 720529 *Iron or steel, pig iron, spiegeleisen; powders (excluding alloy steel)*;

HS 720610 *Iron or non-alloy steel; ingots (excluding iron of heading no. 7203)*;

HS 720690 *Iron or non-alloy steel; primary forms (excluding ingots and iron of heading no. 7203)*;

HS 720711 *Iron or non-alloy steel; semi-finished products of iron or non-alloy steel; containing by weight less than 0.25% of carbon, of rectangular (including square) cross-section, width less than twice thickness*;

HS 720712 *Iron or non-alloy steel; semi-finished products of iron or non-alloy steel; containing by weight less than 0.25% of carbon, of rectangular (other than square) cross-section*;

HS 720719 *Iron or non-alloy steel; semi-finished products of iron or non-alloy steel, containing by weight less than 0.25% of carbon, other than rectangular or square cross-section*;

HS 720720 *Iron or non-alloy steel; semi-finished products of iron or non-alloy steel, containing by weight 0.25% or more of carbon*;

HS 721810 *Steel, stainless; ingots and other primary forms*;

HS 721891 *Steel, stainless; semi-finished products, of rectangular (other than square) cross-section*;

HS 721899 *Steel, stainless; semi-finished products, other than of rectangular cross-section;*

HS 722410 *Steel, alloy; ingots and other primary forms;*

HS 722490 *Steel, alloy; semi-finished products.*

Latest RMIS Dashboard update: August 2021.

### **36.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU28.

Data source(s): EC MSA study (Passarini *et al.*, 2018).

Reference Year: 2015.

Notes: Following the methodology outlined in (Peiró *et al.*, 2018), the indicator is calculated from background data provided by the source.

Latest RMIS Dashboard update: August 2021.

### **36.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **37 Kaolin**

### **37.1 Resources and Reserves**

Country-specific data are not available. Resources of clay minerals are extremely large.

### **37.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (WMD, 2023) (2006-2021) (Eurostat Prodcum, 2023b) (2006-2021) (Dondi, 2019b).

Notes: Available production statistics refer to kaolin (China-clay), whether natural for direct use, beneficiated or washed. Kaolinitic clays (ball and plastic clays) may not be included in the dataset.

Latest RMIS Dashboard update: August 2023.

### **37.3 Production of refined/processed materials**

Not applicable. Calcined kaolin is considered as primary raw material.

### **37.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **37.5 Applications**

Geographical scope: EU28.

Data source(s): (IMA Europe, 2018)(IMA Europe, 2019).

Reference Year: 2017.

Notes: Data reflect kaolin's demand by end use.

Latest RMIS Dashboard update: August 2021.

### **37.6 Trade of primary materials**

Coverage: Data reflect HS 250700 that comprises kaolin (calcined or not) and other kaolinitic clays. Kaolinitic sand classified within HS 250590 is not included, as well other clays (fireclay under HS 250830 and various common clays classified in HS 250840).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Mozambique's, Iran's, and Guyana's trade data for 2019 is derived from reported imports and exports by trade partners. For Ukraine, 'mirror' exports are preferred over reported exports due to significant differences in quantity (about 950 kt are reported as exports by Ukraine, while, according to its partners data, the volume of imports from Ukraine was 2,100 kt). Unit values derived from reported exports are used to estimate Ukraine's export value. Data reported from Egypt in 2019 are sourced from (UN Comtrade, 2022).



Relevant Harmonized System (HS) Codes: HS 250590 Kaolin and other kaolinic clays; whether or not calcined  
Latest RMIS Dashboard update: August 2021.

### **37.7 Trade of refined/processed materials**

Not applicable.

### **37.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Absence of data for the calculation of the EOL-RIR of kaolin in the EU.

### **37.9 Other Indicators**

- ✓ The EU Import Reliance for extraction (primary materials) is sourced from (European Commission, 2023) and refers to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **38 Krypton**

### **38.1 Resources and Reserves**

Not applicable, Krypton is only present in the air in trace amounts and is recovered as by-product in air separation units.

### **38.2 Production of primary materials**

Not applicable. Krypton is obtained from air in air separation units by fractional separation of liquefied air.

### **38.3 Production of refined/processed materials**

#### **38.3.1 Krypton gas**

Coverage: World total.

Time period of compiled data series: 2000-2017.

Reference Year: 2017.

Data source(s): (Elsner, 2018)

Other collected/checked/registered datasets: -

Notes: Publicly-available and country-specific data on production are insufficient to present the global distribution by countries.

Latest RMIS Dashboard update: August 2023.

### **38.4 Additional information and insights about production**

- ✓ The rare gas output distribution is derived from (Elsner, 2018);
- ✓ The calculation of CAGR concerns the production of xenon between 2008 and 2017.

### **38.5 Applications**

Geographical scope: World.

Data source(s): (Elsner, 2018).

Reference Year: 2017.

Notes: Data reflect the distribution of demand by end uses. EU-specific information is unavailable.

Latest RMIS Dashboard update: August 2023.

### **38.6 Trade of primary materials**

Not applicable.

### **38.7 Trade of refined/processed materials**

No data are available in international trade statistics. Available data do not have the required level of disaggregation to identify trade flows of krypton, which is reported in HS 280429 together with other rare gases.

### **38.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No data are available to allow the calculation/estimation of the indicator.

### **38.9 Other Indicators**

-

## **39 Lanthanum**

### **39.1 Resources and Reserves**

No data have been collected. No data have been compiled (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### **39.2 Production of primary materials**

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and lanthanum content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of lanthanum is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### **39.3 Production of refined/processed materials**

The collected information is not publicly available.

### **39.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021)

### **39.5 Applications**

Geographical scope: Europe

Data source(s): (Wood Mackenzie, 2022a)

Reference Year: 2021

Notes: Data associate with end-use demand.

Latest RMIS Dashboard update: August 2023.

### **39.6 Trade of primary materials**

There are no specific codes to lanthanum in international trade statistics (HS). Lanthanum's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).

### **39.7 Trade of refined/processed materials**

There are no specific codes to lanthanum in international trade statistics (HS). Lanthanum's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

### **39.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Information to calculate or estimate the EOL-RIR in the EU is sparse.

### **39.9 Other Indicators**

- ✓ The EU sourcing (EU supply) is sourced from (SCRREEN2, 2023) and associates to all forms of lanthanum. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **40 Lead**

### **40.1 Resources and Reserves**

#### **40.1.1 Resources**

Data source(s): (Mudd *et al.*, 2017).

Reference Year: 2016.

Notes: Based on an extensive compilation of the world's known Pb mineral deposits and their contained resources.

Latest RMIS Dashboard update: August 2023.

#### **40.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **40.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023)

Other collected/checked/registered datasets: (WMD, 2023) (2006-2021), (USGS myb-Pb, 2022) (2015-2019), (ILZSG, 2022) (2016-2021).

Notes: Mine production of lead.

Latest RMIS Dashboard update: August 2023.

### **40.3 Production of refined/processed materials**

#### **40.3.1 Refined lead**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (USGS myb-Pb, 2022) (2015-2019), (ILZSG, 2022) (2016-2021).

Notes: Figures relate to both primary and secondary production and include the lead content of antimonial lead.

Latest RMIS Dashboard update: August 2023.

### **40.4 Additional information and insights about production**

- ✓ The split of refinery production by feedstock origin is sourced from (USGS myb-Pb, 2022);
- ✓ The CAGR refers to the production of refined lead (2012-2021).

## 40.5 Applications

Geographical scope: Europe.

Data source(s): (Oakdene Hollins, 2017a).

Reference Year: 2015.

Notes: Data refer to first & end uses of lead in 13 EU countries + UK + Norway (accounting for >90% of lead use in the EU and EFTA region).

Latest RMIS Dashboard update: August 2021.

## 40.6 Trade of primary materials

Coverage: Data comprise the headings HS 260700 (lead ores and concentrates) and HS 262029 (Pb-containing metallurgical residues used in industry either for the extraction of lead, or as a basis for the manufacture of its chemical compounds). The trade of lead contained as co- or by-product in ores, concentrates and metallurgical residues of other metals (e.g. copper, zinc, silver) is not taken into account.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports originating from Bolivia, Cuba, Myanmar and Tajikistan are derived from the declared imports from destination countries. Iran's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 260700 *Lead ores and concentrates*; HS 262029 *Ash & residues (excl. from the manufacture of iron/steel) containing lead (excl. of 2620.21)*.

Latest RMIS Dashboard update: August 2021.

## 40.7 Trade of refined/processed materials

Coverage: The product aggregate of HS 282410, HS 282490, HS 780110, HS 780191, HS 780199 and HS 780420 is employed for refined/processed lead. The headings considered in the aggregate cover lead monoxide (litharge), lead oxides (red lead and orange lead), unwrought lead at its different degrees of purity (from impure bullion or argentiferous lead to electrolytically refined lead), unwrought antimonial lead, cast anodes for electrolytic refining and cast rods for further processing, and lead powders and flakes. The trade of other lead chemical compounds such as lead sulphide and carbonate and the trade of lead-containing alloys of other metals (e.g. tin alloys) is not included due to the restricted detail of the relevant HS headings. Wrought lead products are excluded (HS 780411; HS 780419; HS 780600).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Mozambique's, Iran's, Guyana's, and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners. Equally, the trade flows of Bolivia, Honduras, Dominican Republic, Sri Lanka, Dominican Republic, DPR Korea, Algeria, Costa Rica, Lebanon, Venezuela, and Bangladesh are approximated from imports/exports reported by their trade partners.

Relevant Harmonized System (HS) Codes: HS 282410 *Lead; lead monoxide (litharge, massicot)*; HS 282490 *Lead oxides; n.e.c. in heading no. 2824*; HS 780110 *Lead; unwrought, refined*; HS 780191 *Lead; unwrought, unrefined, containing by weight antimony as the principal other element*; HS 780199 *Lead; unwrought, unrefined, not containing by weight antimony as the principal other element*; HS 780420 *Lead; powders and flakes*.

Latest RMIS Dashboard update: August 2021.

## **40.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU.

Data source(s): JRC calculation based on (USGS myb-Pb, 2022).

Reference Year: 2019.

Notes: The EOL-RIR is estimated from the ratio "secondary refined lead production/total refined lead production" based on data reported by the source. The output of secondary lead is multiplied by the average Old Scrap Ratio (OSR) for lead reported by (UNEP, 2011) to account for new scrap that may contribute to secondary production.

Latest RMIS Dashboard update: August 2023.

## **40.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).



## **41 Limestone**

### **41.1 Resources and Reserves**

World resources and reserves of limestone suitable for lime and cement manufacture are very large. The global distribution is not available.

### **41.2 Production of primary materials**

Coverage: EU countries (partial).

Time period of compiled data series: 2008-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodcorn, 2023b).

Other collected/checked/registered datasets: -

Notes: Production data with a global coverage are not available. Data concern the product aggregate of limestone flux, limestone used for the manufacture of lime and cement, and chalk. PRC codes: 8112050 *Limestone flux, limestone and other calcareous stone used for the manufacture of lime or cement (excluding crushed limestone aggregate and calcareous dimension stone)*; 8113010 *Chalk*.

Latest RMIS Dashboard update:

### **41.3 Production of refined/processed materials**

#### **41.3.1 Lime (all products)**

Coverage: EU total.

Time period of compiled data series: 2003-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodcorn, 2023a).

Other collected/checked/registered datasets:

Notes: Available information is inadequate to make reliable estimates of output for several countries worldwide. Data concern the product aggregate of quicklime, slaked lime & hydraulic lime. PRC codes: 23521033 *Quicklime*, 23521035 *Slaked lime*, 23521050 *Hydraulic lime*.

Latest RMIS Dashboard update: August 2023.

#### **41.3.2 Quicklime**

Coverage: EU countries (partial).

Time period of compiled data series: 2003-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodcorn, 2023a).

Other collected/checked/registered datasets: -

Notes: PRC code 23521033 *Quicklime*.

Latest RMIS Dashboard update: August 2023..

#### **41.3.3 Slaked lime**

Coverage: EU countries (partial).

Time period of compiled data series: 2003-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodc, 2023a).

Other collected/checked/registered datasets: -

Notes: PRC code 23521035 *Slaked lime*.

Latest RMIS Dashboard update: August 2023.

#### **41.3.4 Hydraulic lime**

Coverage: EU countries (partial).

Time period of compiled data series: 2003-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodc, 2023a).

Other collected/checked/registered datasets: -

Notes: PRC code 23521050 *Hydraulic lime*.

Latest RMIS Dashboard update: August 2023.

#### **41.3.5 Cement clinker**

Coverage: EU countries (partial).

Time period of compiled data series: 2009-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodc, 2023a).

Other collected/checked/registered datasets: -

Notes: PRC code 23511100 *Cement clinker*.

Latest RMIS Dashboard update: August 2023.

#### **41.3.6 Precipitated Calcium Carbonate**

Coverage: EU countries (partial).

Time period of compiled data series: 2003-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodc, 2023a).

Other collected/checked/registered datasets: -

Notes: PRC code 20134340 Calcium carbonate (precipitated).

Latest RMIS Dashboard update: August 2023.

### **41.4 Additional information and insights about production**

- ✓ Limestone's production by product category in the EU is derived from (Eurostat Prodc, 2023b).

### **41.5 Applications**

Geographical scope: EU.

Data source(s): Expert judgment in (European Commission, 2020b) by (IMA Europe, 2019).

Reference Year: NA

Notes: The definition of 'Limestone' is very broad covering product categories such as such limestone flux for industrial uses and agriculture, limestone for cement, lime, (precipitated) calcium carbonate, chalk. Robust data for the distribution of demand of each product category are not available.

Latest RMIS Dashboard update: August 2023.

#### **41.6 Trade of primary materials**

Coverage: The trade of calcareous materials (e.g. chalk, limestone flux) used for industrial and/or construction applications is considered.

Data source(s): (WITS, 2023)

Reference Year: 2021

Notes: -

Relevant Harmonized System (HS) Codes: HS 250900 *Chalk*; HS 251741 *Granules, chippings & powder, of marble, whether/not heat-treated*; HS 252100 *Limestone flux; limestone & other calcareous stone, of a kind used for the manufacture of lime/cement*

Latest RMIS Dashboard update: August 2023

#### **41.7 Trade of refined/processed materials**

Coverage: The aggregate of trade flows of lime (construction & industrial), cement clinker, cement and calcium carbonate is considered to represent the trade of processed products of limestone.

Data source(s): (WITS, 2023)

Reference Year: 2021

Notes: -

Relevant Harmonized System (HS) Codes: HS 252210 *Quicklime*; HS 252220 *Slaked lime*; HS 252230 *Hydraulic lime, other than calcium oxide & hydroxide of 28.25*; HS 252310 *Cement clinkers*; HS 252321 *White cement, whether/not artificially coloured*; HS 252329 *Portland cement (excl. white cement, whether/not artificially coloured), whether/not coloured*; HS 252330 *Aluminous cement, whether/not coloured/in the form of clinkers*; HS 252390 *Hydraulic cements (e.g., slag cement, supersulphate cement), whether/not coloured/in the form of clinkers (excl. cement clinkers, Portland cement & aluminous cement)*; HS 283650 *Calcium carbonate*.

Latest RMIS Dashboard update: August 2023

#### **41.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Available data in order to calculate or estimate the indicator are insufficient.

#### **41.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **42 Lithium**

### **42.1 Resources and Reserves**

#### **42.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **42.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **42.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) and (USGS myb-Li, 2022) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021) (USGS myb-Li, 2022) (2000-2020).

Notes: Data are converted to LCE from the units reported by the data sources.

Latest RMIS Dashboard update: August 2023.

### **42.3 Production of refined/processed materials**

#### **42.3.1 Refined lithium**

Coverage: World total.

Time period of compiled data series: 2011-2020.

Reference Year: 2020.

Data source(s): (JRC, 2021) .

Other collected/checked/registered datasets: -

Notes: Production statistics of refined lithium compounds are not published. The data shown are a JRC estimate, based on several sources and information, of the global output of lithium chemicals (carbonate, hydroxide, chloride) via chemical conversion of lithium concentrates and brine processing at integrated refineries.

Latest RMIS Dashboard update: August 2023.

### **42.4 Additional information and insights about production**

- ✓ The mine capacity per lithium deposit category is based on JRC analysis (JRC, 2021);

- ✓ The production capacity of refined lithium (by country and by product & grade) originates from JRC analysis (JRC, 2021);
- ✓ The CAGR refers to primary (mining) production (2012-2021).

## 42.5 Applications

Geographical scope: EU.

Data source(s): EC MSA study (Matos, Ciacci, *et al.*, 2020).

Reference Year: 2016.

Notes: The distribution of demand relates to products 'used' in the EU, i.e. to end uses.

Latest RMIS Dashboard update: August 2021.

## 42.6 Trade of primary materials

There is no individual HS code that contains only lithium primary materials. Trade of lithium minerals is classified within HS 253090, which is not exclusively associated with lithium minerals as it linked to a variety of raw materials.

## 42.7 Trade of refined/processed materials

Coverage: Aggregate of HS 282520 and HS 283691, covering lithium carbonate, lithium hydroxide and synthetic lithium oxide. Lithium metal is not included as the relevant heading (HS 280519) contains several metals.

Data source(s): (WITS, 2021)

Reference Year: 2019

Notes: Argentinian exports were derived from 'mirror' imports in (UN Comtrade, 2022). Iran's and Ukraine's trade flows are also derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 282520 *Lithium oxide and hydroxide*; HS 283691 *Lithium carbonates*

Latest RMIS Dashboard update: August 2021.

## 42.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU.

Data source(s): EC MSA study (Matos, Ciacci, *et al.*, 2020).

Reference Year: 2016.

Notes: The indicator is calculated from background data reported by the source in accordance with the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020).

Latest RMIS Dashboard update: August 2021.

## 42.9 Other Indicators

- ✓ The EU sourcing (EU supply) for processing (refined materials), and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **43 Light Rare Earth Elements (LREE)**

### **43.1 Resources and Reserves**

No data have been compiled (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### **43.2 Production of primary materials**

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC elaboration based on the total REE production (see 67.2).

Other collected/checked/registered datasets: -

Notes: The LREE group comprises lanthanum, cerium, praseodymium, neodymium and samarium. Figures are the aggregate of the estimated production of each LREE.

Latest RMIS Dashboard update: August 2023.

### **43.3 Production of refined/processed materials**

#### **43.3.1 Refined LREE**

Coverage: World countries

Time period of compiled data series: 2021

Reference Year: 2021

Data source(s): (Wood Mackenzie, 2022b)

Other collected/checked/registered datasets: -

Notes: Data aggregate the estimated production of refined lanthanum, cerium, praseodymium, neodymium and samarium. Recycling is included.

Latest RMIS Dashboard update: August 2023.

### **43.4 Additional information and insights about production**

- ✓ The repartition of mine production by REE group is based on JRC analysis;
- ✓ The breakdown of refined LREE production by source is elaborated from (Wood Mackenzie, 2022b);
- ✓ The CAGR refers to primary (mining) production from 2012 to 2021.

### **43.5 Applications**

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021

Notes: Data correspond to end-use demand.

Latest RMIS Dashboard update: August 2023.

### **43.6 Trade of primary materials**

Data are not available in the HS nomenclature (See section 67.6).

### **43.7 Trade of refined/processed materials**

Data are not available in the HS nomenclature (See section 67.7).

### **43.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Available data are incomplete in order to allow the calculation or estimation of the EOL-RIR in the EU. The EOL-RIR globally is estimated to be 14% (as the ratio of post-consumer recycling to global supply) in 2021 on the basis of data sourced from (Wood Mackenzie, 2022a); nevertheless, it is considered that the figure is not applicable to the EU.

### **43.9 Other Indicators**

- ✓ The Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 44 Lutetium

### 44.1 Resources and Reserves

No data have been compiled (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### 44.2 Production of primary materials

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and lutetium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of lutetium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### 44.3 Production of refined/processed materials

The gathered information is not accessible in the public domain.

### 44.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 44.5 Applications

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data refer to lutetium's demand by end use.

Latest RMIS Dashboard update: August 2023.

### 44.6 Trade of primary materials

There are no specific codes to lutetium in international trade statistics (HS). Their trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).

### 44.7 Trade of refined/processed materials

There are no specific codes to lutetium in international trade statistics (HS). Its trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).



#### **44.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Data to calculate the EOL-RIR in the EU are missing.

#### **44.9 Other Indicators**

- ✓ The EU sourcing (EU supply) is sourced from (SCREEN2, 2023) and relates to all forms of lutetium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used are provided by (SCREEN2, 2023).

## 45 Magnesite

### 45.1 Resources and Reserves

#### 45.1.1 Resources

Data source(s): (Wilson, 2015).

Reference Year: 2009.

Notes: Identified world magnesite resources. **No information provided on the classification system.**

Latest RMIS Dashboard update: August 2021.

#### 45.1.2 Reserves

Data source(s): (USGS, 2023).

Reference Year: 2022.

Notes: Reserves are defined according to the USGS classification system (USGS, 1980).

Other collected/checked/registered datasets: (O'Driscoll, 2018).

Latest RMIS Dashboard update: August 2023.

### 45.2 Production of primary materials

Coverage: World.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (USGS myb-Mg compounds, 2023) for 2000-2005.

Other collected/checked/registered datasets: (USGS myb-Mg compounds, 2023) (2006-2021), (BGS, 2023) (2000-2021).

Notes: Production of magnesium chloride and other magnesium-bearing compounds that can be recovered from seawater or brines is excluded.

Latest RMIS Dashboard update: August 2023.

### 45.3 Production of refined/processed materials

Production data on processed magnesia compounds (caustic-calcined, dead-burned and fused magnesia) are not available.

### 45.4 Additional information and insights about production

- ✓ Data on the annual production capacity of magnesia (by feedstock, country and compound) are obtained from (USGS myb-Mg compounds, 2023). Magnesia's production capacity comprises installations treating magnesite and magnesium compounds from seawater or brines;
- ✓ The CAGR refers to primary (mining) production (2012-2021);
- ✓ Country-specific data related to production capacity in 2021 are used as a proxy for the calculation of the HHI index of refined production.

### 45.5 Applications

Geographical scope: World

Data source(s): (Euromines, 2020), data from Industrial Minerals Forum and Research (IMFORMED).

Reference Year: Average over 2012-2016.

Notes: Data relate to the main end uses of magnesia and it is presumed to be also applicable in the EU.

Latest RMIS Dashboard update: August 2021.

## 45.6 Trade of primary materials

Coverage: Data refer to HS 251910 covering crude magnesite.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports of Brazil, Australia and Saudi Arabia are derived from reported imports by country destinations in (UN Comtrade, 2022). Mozambique's, Iran's, and Ukraine's trade for 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 251910 *Magnesium carbonate (magnesite); natural*

Latest RMIS Dashboard update: August 2021.

## 45.7 Trade of refined/processed materials

Coverage: Data from HS 251990 are used. The heading covers the various types of magnesia (caustic-calcined, dead-burned and fused).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Mozambique's, Iran's and Ukraine's trade for 2019 is derived from reported imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 251990 *Magnesia, fused or dead-burned (sintered); whether or not containing small quantities of other oxides added before sintering, other magnesium oxide, whether or not pure, (not natural magnesium carbonate).*

Latest RMIS Dashboard update: August 2021.

## 45.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: The indicator is calculated from background data provided by the source according to the methodology described in (Peiró *et al.*, 2018).

Latest RMIS Dashboard update: August 2021.

## 45.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 46 Magnesium

### 46.1 Resources and Reserves

See 45.1 for the resources and reserves of magnesite, one of the raw materials used for magnesium production.

### 46.2 Production of primary materials

Dolomite (calcium–magnesium carbonate), magnesite (magnesium carbonate), and brines (magnesium chloride) are the most commonly used mineral resources for the metallurgical extraction of magnesium. Data on the quantities of the above minerals destined for the production of magnesium metal are not available. Magnesite producing countries are presented in the Raw Material *Magnesite*.

### 46.3 Production of refined/processed materials

#### 46.3.1 Magnesium metal

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023)

Other collected/checked/registered datasets: (USGS myb-Mg, 2023) (2000-2021)

Notes: Data refer to magnesium metal production from primary sources. Data for Russia (2000-2020), Ukraine and Kazakhstan (2012-2020) are collected from (USGS myb-Mg, 2023) in order to include magnesium used within the process of titanium sponge production (even though it is not marketed as primary magnesium metal).

Latest RMIS Dashboard update: August 2023.

### 46.4 Additional information and insights about production

- ✓ The production capacity of magnesium metal is sourced from (USGS myb-Mg, 2023);
- ✓ The CAGR refers to the production magnesium metal between 2012 and 2021.

### 46.5 Applications

Geographical scope: EU28.

Data source(s): (Oakdene Hollins, 2017b).

Reference Year: 2012.

Notes: The reported figures are associated with end-use demand.

Latest RMIS Dashboard update: August 2021.

### 46.6 Trade of primary materials

No data are available for the trade of magnesium's primary raw materials. Primary magnesium metal is produced from dolomite (85%), carnallite and Mg-rich brines (15%) (Schmitz, 2019). The HS nomenclature does not provide the required detail to distinguish the flows of minerals destined for magnesium primary production, among their other uses.

## 46.7 Trade of refined/processed materials

Coverage: Data involve the aggregate of HS 810411, HS 810419 and HS 810430 covering unwrought magnesium, and magnesium raspings, turnings, granules and powders. The trade of magnesium compounds is excluded (hydroxide, chloride, sulphate etc).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Mozambique's, Iran's and Ukraine's trade for 2019 is deduced from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 810411 *Magnesium; unwrought, containing at least 99.8% by weight of magnesium*; HS 810419 *Magnesium; unwrought, containing less than 99.8% by weight of magnesium*; HS 810430 *Magnesium; raspings, turnings and granules, graded according to size, powders*.

Latest RMIS Dashboard update: August 2021.

## 46.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU28

Data source(s): (Oakdene Hollins, 2017b)

Reference Year: 2012

Notes: Data from the (Oakdene Hollins, 2017b) study are prioritised over (BIO by Deloitte, 2015) due to a more precise consideration of specific streams.

Latest RMIS Dashboard update: August 2021.

## 46.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **47 Manganese**

### **47.1.1 Resources and Reserves**

#### **47.1.2 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards

Latest RMIS Dashboard update: August 2023.

#### **47.1.3 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023

## **47.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2001-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (InMnl, 2016) for 2001-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2000-2021), (InMnl, 2016) (2006-2013), (USGS myb-Mn, 2023) (2000-2021).

Notes: -

Latest RMIS Dashboard update: August 2023.

## **47.3 Production of refined/processed materials**

### **47.3.1 Manganese ferroalloys**

Coverage: World countries.

Time period of compiled data series: 2000-2020.

Reference Year: 2020.

Data source(s): (USGS myb-ferroalloys, 2023).

Other collected/checked/registered datasets: (BGS, 2023) (2000-2021), (InMnl, 2016) (2006-2013), (USGS myb-Mn, 2023) (2000-2021).

Notes: Data present the aggregated production of manganese ferroalloys, consisting of ferro-manganese (FeMn) and silico-manganese (SiMn).

RMIS Dashboard update: August 2023.

### **47.3.2 Ferromanganese**

Coverage: World countries

Time period of compiled data series: 2000-2020.

Reference Year: 2020.

Data source(s): (USGS myb-ferroalloys, 2023).

Other collected/checked/registered datasets: (BGS, 2023) (2000-2021), (InMnl, 2016) (2006-2013), (USGS myb-Mn, 2023) (2000-2021).

Notes: Data concern the production of ferro-manganese (FeMn).

Latest RMIS Dashboard update: August 2023.

### **47.3.3 Silicomanganese**

Coverage: World countries.

Time period of compiled data series: 2000-2020.

Reference Year: 2020.

Data source(s): (USGS myb-ferroalloys, 2023).

Other collected/checked/registered datasets: (BGS, 2023) (2000-2021), (InMnl, 2016) (2006-2013), (USGS myb-Mn, 2023) (2000-2021).

Notes: Data show the production of silico-manganese (SiMn).

Latest RMIS Dashboard update: August 2023.

### **47.3.4 Electrolytic manganese metal (EMM)**

Coverage: World countries.

Time period of compiled data series: 2012-2020.

Reference Year: 2020.

Data source(s): JRC elaboration based on (InMnl, 2021), (JRC, 2021) and (UN Comtrade, 2023).

Other collected/checked/registered datasets: -

Notes: The output of Ukraine in 2012-2020 and Gabon in 2015-2020 is approximated on the basis of reported exports and imports declared by trade partners, respectively (HS 811100). South African production is assumed to consist entirely of High-Purity Electrolytic manganese metal (HP EMM) in 2014-2020. Indonesia's captive output in 2019-2020 is estimated capacity information for steel production.

Latest RMIS Dashboard update: June 2023

## **47.4 Additional information and insights about production**

- ✓ The production capacity of manganese mines is based on JRC analysis and data collection (JRC, 2021);
- ✓ The capacity of refined manganese products is based on (JRC, 2021) and (InMnl, 2021);
- ✓ Data related to the production capacity of battery-grade manganese (EMD+HP EMM+HP MSM) are collected from (InMnl, 2021);
- ✓ The CAGR refers to the output of mined manganese between 2012 and 2021.

## **47.5 Applications**

Geographical scope: EU.

Data source(s): EC MSA study (Matos, Ciacci, *et al.*, 2020)

Reference Year: 2016.

Notes: The distribution of demand relates to products 'used' in the EU, i.e. to end uses.

Latest RMIS Dashboard update: August 2021.

## 47.6 Trade of primary materials

Coverage: Data are linked to HS 260200 covering manganese ore and concentrates, including manganiferous iron ore. Ferruginous manganese ores and concentrates with a Mn content of less than 20% (dry weight) are not covered by HS 260220 but by iron ores and concentrates (HS 2601). The trade of pyrolousite for use in dry batteries is not included as it is classified under HS heading 253090 of inadequate level of detail.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports originating from Australia, Gabon, Mexico, Myanmar and other countries are derived from the declared imports by destination countries. Mozambique's, Guyana's, Iran's, Oman's and Ukraine's trade for 2019 is determined from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 260200 *Manganese ores and concentrates, including ferruginous manganese ores and concentrates with a manganese content of 20% or more, calculated on the dry weight*

Latest RMIS Dashboard update: August 2021.

## 47.7 Trade of refined/processed materials

Coverage: The trade of refined/processed manganese is determined by the product aggregate of HS 282010, HS 282090, HS 284161, HS 284169, HS 720211, HS 720219, HS 720230 and HS 811100. The product aggregate considered covers manganese dioxide and other manganese oxides, permanganates and manganites, high-carbon ferromanganese (HCFEMn), refined ferromanganese (MCFEMn) and low-carbon ferromanganese (LCSiMn), ferrosilicomanganese and unwrought manganese (Mn articles included in the relevant HS heading). Pig iron alloyed with manganese (spiegeleisen) is excluded (HS 720150).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Gabon exports are sourced from reported imports by destination countries. Ukraine's and Iran's trade for 2019 is determined from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 282010 *Manganese dioxide*; HS 282090 *Manganese oxides; excluding manganese dioxide*; HS 284161 *Salts; of oxometallic or peroxometallic acids, manganites, manganates and permanganates, potassium permanganate*; HS 284169 *Salts; of oxometallic or peroxometallic acids, manganites, manganates and permanganates, other than potassium permanganate*; HS 720211 *Ferro-manganese, containing by weight >2% of carbon, in granular/powder form*; HS 720219 *Ferro-alloys; ferro-manganese, containing by weight 2% or less of carbon*; HS 720230 *Ferro-alloys; ferro-silico-manganese*; HS 811100 *Manganese; articles thereof, including waste and scrap*.

Latest RMIS Dashboard update: August 2021.

## 47.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU.

Data source(s): EC MSA study (Matos, Ciacci, *et al.*, 2020).

Reference Year: 2016.

Notes: The indicator is calculated from background data provided by the source in accordance with the methodology defined by (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020).

Latest RMIS Dashboard update: August 2021.



## 47.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 48 Mica

### 48.1 Resources and Reserves

#### 48.1.1 Resources

Estimates of world's mica resources are not available. Resources of scrap and flake mica are evaluated as more than adequate to meet anticipated world demand in the foreseeable future. No formal evaluation of world resources of sheet mica has been conducted because of its sporadic occurrence. (USGS, 2023) (Kogel *et al.*, 2006).

#### 48.1.2 Reserves

No figures are displayed because available data are limited and have a partial country coverage.

### 48.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source: (BGS, 2023)

Other data sources checked and/or compiled: (USGS myb-mica, 2022) (2000-2021).

Notes: Data relate to all grades of mica (crude, concentrates, ground, scrap & waste) and minerals of the mica group (e.g. biotite). Data for Austria, Nigeria and Peru are gathered from (USGS myb-mica, 2022), as well as Brazil's production in 2014.

Latest RMIS Dashboard update: August 2023.

### 48.3 Production of refined/processed materials

No data are available for processed products of mica.

### 48.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production between 2012 and 2021.

### 48.5 Applications

Geographical scope: United States.

Data source: (USGS myb-mica, 2022).

Reference Year: 2021.

Notes: No data are available for the breakdown of mica's demand worldwide or in the EU. Data show the breakdown of consumption by end uses, which is assumed to also apply in the EU.

Latest RMIS Dashboard update: August 2023.

### 48.6 Trade of primary materials

Coverage: Data reflect the trade of unworked (crude) mica, split block mica, mica splittings, flake mica and mica waste.

Data source: (WITS, 2023).

Reference Year: 2021.

Notes:

Relevant Harmonized System (HS) Codes: HS 252510 *Crude mica & mica rifted into sheets/splittings*; HS 252520 *Mica powder*; HS 252530 *Mica waste*.

Latest RMIS Dashboard update: August 2023.

## **48.7 Trade of refined/processed materials**

Coverage: Figures show the trade of worked mica products made from mica sheets or splittings.

Data source: (WITS, 2023).

Reference Year: 2021.

Notes:

Relevant Harmonized System (HS) Codes: HS 681410 Plates, sheets and strips of agglomerated or reconstituted mica, whether or not on a support of paper, paperboard or other materials, in rolls or merely cut into square or rectangular shapes; HS 681490 Worked mica and articles of mica (excl. electrical insulators, insulating fittings, resistors and capacitors, protective goggles of mica and their glasses, mica in the form of Christmas tree decorations, and plates, sheets and strips of agglomerated or reconstituted mica, whether or not on supports).

Latest RMIS Dashboard update: August 2023.

## **48.8 End-of-Life Recycling Input Rate (EOL-RIR)**

There are no data to calculate the EOL-RIR in the EU.

## **48.9 Other Indicators**

- ✓ No data are presented for the Import Reliance and the EU sourcing as mica was not among the candidate materials in the 2023 EU assessment of Critical raw materials (European Commission, 2023).

## **49 Molybdenum**

### **49.1 Resources and Reserves**

#### **49.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023

#### **49.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **49.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (USGS myb-Mo, 2023) (2000-2021).

Notes: -

Latest RMIS Dashboard update: August 2023.

### **49.3 Production of refined/processed materials**

#### **49.3.1 Ferromolybdenum**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023) (USGS myb-ferroalloys, 2023).

Other collected/checked/registered datasets: -

Notes: Belgium's production is a JRC estimate based on (Eurostat Prodcum, 2023a) (PRC code 24101275). China's and Chile's production is sourced from (USGS myb-ferroalloys, 2023) for 2000-2020 and 2000-2011, respectively. The Chinese production for 2021 is assumed identical to 2020.

Latest RMIS Dashboard update: August 2023.

#### **49.3.2 Molybdenum oxides & hydroxides**

Coverage: EU total.

Time period of compiled data series: 2014-2021

Reference Year: 2021.

Data source(s): (Eurostat Prodc, 2023b).

Other collected/checked/registered datasets: -

Notes: PRC code: 20121973. The figure for 2020 is an estimate (interpolation).

Latest RMIS Dashboard update: August 2023.

### **49.3.3 Molybdenum metal**

Coverage: EU total.

Time period of compiled data series: 2014-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodc, 2023b).

Other collected/checked/registered datasets: -

Notes: Data comprise unwrought, powders & wrought molybdenum. PRC code: 24453017. The figure in 2017 is estimated (interpolation).

Latest RMIS Dashboard update: August 2023.

## **49.4 Additional information and insights about production**

- ✓ Data regarding the principal commodity in the molybdenum producing mines are collected from (S&P, 2023);
- ✓ The CAGR relates to primary (extraction) production in 2012-2021.

## **49.5 Applications**

Geographical scope: World.

Data source(s): (IMOA, 2023).

Reference Year: 2021.

Notes: First uses of molybdenum. Figures relate to molybdenum produced from mined ore, not to scrap material recycled by chemical processes or remelting. EU-related data are not available. It is supposed that the figures are also applicable for the EU.

Latest RMIS Dashboard update: August 2023.

## **49.6 Trade of primary materials**

Coverage: Data are the aggregate of HS 261310 and HS 261390 comprising of molybdenite concentrates (molybdenite and wulfenite) and technical molybdic oxide (MTO) obtained by roasting molybdenite concentrates (intermediate product). Molybdenite concentrates for non-metallurgical uses are not included as they are classified under the highly aggregated HS heading 253090 *Mineral substances; n.e.c. in chapter 25*.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports originating from Mexico are derived from the declared imports from destination countries. Iran's, and Ukraine's trade for 2019 is obtained from reported imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 261310 *Molybdenum ores and concentrates; roasted*; HS 261390 *Molybdenum ores and concentrates; other than roasted*.

Latest RMIS Dashboard update: August 2021.

### **49.7 Trade of refined/processed materials**

Coverage: To reflect the global trade of refined/processed products of molybdenum, the aggregate of headings HS 282570, HS 284170, HS 720270, HS 810210 and HS 810294 is used. The product aggregate includes molybdenum compounds (oxides & hydroxides, molybdates), ferro-molybdenum, molybdenum powders, and unwrought molybdenum metal in compact forms. The trade of molybdenum scrap, and molybdenum bars and rods obtained by sintering is also contained within in the product aggregate.

Data source(s): (WITS, 2021)

Reference Year: 2019

Notes: Iran's, Mozambique's and Ukraine's trade for 2019 is deduced from reported imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 282570 *Molybdenum oxides and hydroxides*; HS 284170 *Salts; molybdates*; HS 720270 *Ferro-alloys; ferro-molybdenum*; HS 810210 *Molybdenum; articles thereof, including waste and scrap, powders*; HS 810294 *Molybdenum; unwrought, including bars and rods obtained simply by sintering*.

Latest RMIS Dashboard update: August 2021.

### **49.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: World.

Data source(s): JRC elaboration based on data in (IMOA, 2013) and the global primary production for the reference year sourced from (WMD, 2023).

Reference Year: 2011.

Notes: Data used for old scrap include Mo units that come from a different scrap source than the product for which it is intended. Revert and new scrap was excluded from the calculation. It is assumed that the indicator's value is also applicable for the EU.

Latest RMIS Dashboard update: August 2023.

### **49.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for the extraction stage (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 50 Natural cork

### 50.1 Resources and Reserves

#### 50.1.1 Resources

Not applicable.

#### 50.1.2 Reserves

Data source(s): (APCOR, 2021)

Reference Year: Varies per country. The background data used by the source for each country are: Portugal: Inventário Florestal Nacional (IFN6), 2019; Spain: MARM, 2012; Italy: FAO, 2005; France: IM Liège, 2005; Morocco: HCEF Maroc, 2011; Algeria: EFI, 2009; Tunisia: Ben Jamaa, 2011.

Notes: The area covered by Cork oak forests worldwide is considered to represent reserves.

Latest RMIS Dashboard update: October 2022

### 50.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2013-2020.

Reference Year: 2020.

Data source(s): (APCOR, 2021)(APCOR, 2019b).

Other collected/checked/registered datasets: Supplementary sources used for data assessment: (APCOR, 2015)(APCOR, 2020)(APCOR, 2019a)(Rives *et al.*, 2011)(Sierra-Pérez *et al.*, 2015).

Notes: Production data are obtained from the yearly APCOR publications. The production figures are annual average estimates of extracted raw natural cork. The estimates for Portugal were updated in 2019, whereas for the rest of the countries the estimates of output are based on FAO data from 2010.

Latest RMIS Dashboard update: October 2022.

### 50.3 Production of refined/processed materials

#### 50.3.1 Prepared natural cork

Coverage: EU countries.

Time period of compiled data series: 2003-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodcom, 2023a).

Other collected/checked/registered datasets: -

Notes: Data for processed forms of natural cork are not available at the global level. Figures for prepared natural cork are associated with PRC code 16292150 *Natural cork, debarked or roughly squared, in rectangular or square blocks, plates, sheets or strips.*

Latest RMIS Dashboard update: June 2023

### 50.4 Additional information and insights about production

- ✓ The CAGR refers to primary production (extraction) in 2012-2021.

## 50.5 Applications

Geographical scope: World

Data source(s): (APCOR, 2021).

Reference Year: 2020

Notes: The breakdown of demand by end use sector is based on the structure of Portuguese sales worldwide. Data for the EU are not available, but it is assumed that the figures are also representative of the EU demand.

Latest RMIS Dashboard update: October 2022

## 50.6 Trade of primary materials

Coverage: Aggregate of HS 450110 and HS 450190 of natural cork raw materials, as well as of HS 450200 that entails a higher degree of natural cork preparation for the manufacture of downstream products.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Import data for some countries that are missing from the WITS dataset (e.g. Ukraine) are obtained from 'mirror data', i.e. exports declared by reporting partners in (UN Comtrade, 2022).

Relevant Harmonized System (HS) Codes: HS 450110 *Cork; natural cork, raw or simply prepared*; HS 450190 *Cork; waste cork, crushed, granulated or ground cork*; HS 450200 *Cork; natural cork, debarked or roughly squared, or in rectangular (including square) blocks, plates, sheets or strip, (including sharp-edged blanks for corks or stoppers)*.

Latest RMIS Dashboard update: August 2021.

## 50.7 Trade of refined/processed materials

Several products made from natural cork such as cork stoppers, articles made of natural cork, agglomerated cork products etc., are classified as semi-finished or finished products (downstream in the value chain).

## 50.8 End-of-Life Recycling Input Rate (EOL-RIR)

Recent and robust data for the EOL-RIR of natural cork are not available. According to data from (Amorim and Sggs, 2008), 8% of the raw extracted cork used by a Portuguese producer of cork stopper was recovered for energy use in 2005.

## 50.9 Other Indicators

- ✓ The EU sourcing (EU supply) for extraction (primary materials) is derived from (European Commission, 2023) and (SCRREEN2, 2023) and refers to the average 2016-2020. The Import Reliance for extraction (primary materials) is sourced from (European Commission, 2023) and relates to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).



## 51 Natural graphite

### 51.1 Resources and Reserves

#### 51.1.1 Resources

Data source(s): JRC elaboration based on data from (S&P, 2022) and (Robinson *et al.*, 2017).

Reference Year: 2021

Notes: Data from two different sources are analysed in order to achieve a more comprehensive coverage of the world's graphite resources (flake, amorphous and vein).

Latest RMIS Dashboard update: August 2023.

#### 51.1.2 Reserves

Data source(s): JRC elaboration based on data from (S&P, 2022) and (Robinson *et al.*, 2017).

Reference Year: 2021.

Notes: Data from two different sources are analysed in order to achieve a more comprehensive coverage of the world's graphite reserves (flake, amorphous and vein).

Latest RMIS Dashboard update: August 2023.

### 51.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-graphite, 2023) (2000-2021).

Notes: Production data concern all forms of mined natural graphite (flake, amorphous, vein). Data for China in 2013-2021 are obtained from USGS. Data for Pakistan and Tanzania in 2006-2021 are collected from BGS. Data for Uzbekistan are derived from USGS (2000-2021).

Latest RMIS Dashboard update: August 2023.

### 51.3 Production of refined/processed materials

Production statistics concerning the refined forms of natural graphite (e.g. spherical graphite) are not readily available.

### 51.4 Additional information and insights about production

- ✓ The mine production per graphite type is based on JRC analysis and data collection (JRC, 2021);
- ✓ The mine capacity of flake natural graphite is derived from JRC analysis and data collection (JRC, 2021);
- ✓ The total production capacity of battery anode precursors originates from (JRC, 2021) and (BMI, 2021);
- ✓ The production capacity of purified spherical graphite (PSG) for battery anodes is based on (JRC, 2021) and (BMI, 2021);
- ✓ The CAGR related to natural graphite mine production in 2012-2021.

## 51.5 Applications

Geographical scope: EU.

Data source(s): EC MSA study (Matos, Ciacci, *et al.*, 2020).

Reference Year: 2016.

Notes: The distribution of demand relates to products 'used' in the EU, i.e. to end uses.

Latest RMIS Dashboard update: August 2021.

## 51.6 Trade of primary materials

Coverage: Data correspond to the product aggregate of HS 250410 and HS 250490. Intermediate and processed forms of natural graphite, i.e. when it has been heat treated to remove impurities, remain in these headings. According to (Zhou and Damm, 2020), HS 250410 corresponds to flake graphite and HS 250490 to amorphous graphite.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Trade flows of Iran, Mozambique, and Ukraine for 2019 are deduced from reported imports and exports by trade partners. Also, exports of Sri Lanka and Tanzania for 2019 are derived from declared imports by destination countries.

Relevant Harmonized System (HS) Codes: HS 250410 *Graphite; natural, in powder or in flakes*; HS 250490 *Graphite; natural, in other forms, excluding powder or flakes*

Latest RMIS Dashboard update: August 2021.

## 51.7 Trade of refined/processed materials

No specific codes exist in the HS nomenclature for refined/processed forms of natural graphite. Spherical graphite may be reported under heading HS 250410, which is allocated to primary materials of natural graphite. Colloidal and semi-colloidal graphite (HS 380120) are excluded as they are assessed being downstream products.

## 51.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU.

Data source(s): EC MSA study (Matos, Ciacci, *et al.*, 2020).

Reference Year: 2016.

Notes: The indicator is calculated from background data provided by the source in line with the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020)

Latest RMIS Dashboard update: August 2021.

## 51.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **52 Natural rubber**

### **52.1 Resources and Reserves**

#### **52.1.1 Resources**

Data source(s): (FAO, 2020c), (FAOSTAT, 2023b).

Reference Year: 2020.

Notes: Areas of rubber plantations reflect resources of natural rubber. For rubber-producing countries that did not report on their rubber plantation resources in (FAO, 2020a) and were missing from the totals, the area harvested in 2021 provided by (FAOSTAT, 2023b) is considered a proxy of their resources.

Latest RMIS Dashboard update: August 2023.

#### **52.1.2 Reserves**

Data source(s): (FAOSTAT, 2023b).

Reference Year: 2020.

Notes: The area harvested (measured in hectares) is assumed an equivalent indicator for reserves.

Latest RMIS Dashboard update: August 2023.

### **52.2 Production of primary materials**

Coverage: World countries.

Data source(s): (FAOSTAT, 2023b).

Reference Year: 2021.

Time period of compiled data series: 2000-2021.

Other collected/checked/registered datasets:

Notes: Data relate to the production of natural rubber in primary forms. Latest data update in the source: 24-3-2023

Latest RMIS Dashboard update: August 2023.

### **52.3 Production of refined/processed materials**

No publicly available data exist for the production of natural rubber in processed forms.

### **52.4 Additional information and insights about production**

- ✓ The CAGR refers to primary production (extraction).

### **52.5 Applications**

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: The distribution of demand relates to products 'used' in the EU, i.e. to end uses.

Latest RMIS Dashboard update: August 2021.

## 52.6 Trade of primary materials

Coverage: The trade of natural rubber's primary materials is described by HS 400110 comprising natural rubber latex, whether or not pre-vulcanised.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Mozambique's, Guyana's, Iran's, and Ukraine's trade are derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 400110 Rubber; natural rubber latex, whether or not pre-vulcanised, in primary forms or in plates, sheets or strip.

Latest RMIS Dashboard update: August 2021.

## 52.7 Trade of refined/processed materials

Coverage: The trade of natural rubber's processed materials is provided by the aggregate of HS 400121, HS 400122 and HS 400129. These headings address the trade of processed latex into different natural rubber products and grades such as ribbed smoked sheets.

Data source(s): (WITS, 2021)

Reference Year: 2019.

Notes: Mozambique's, Iran's, Guyana's, and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 400121 *Rubber; natural (excluding latex), in smoked sheets*; HS 400122 *Rubber; technically specified natural rubber (TSNR), in primary forms or in plates, sheets or strip (excluding latex and smoked sheets)*; HS 400129 *Rubber; natural (excluding latex, technically specified natural rubber and smoked sheets), in primary forms or in plates, sheets or strip*.

Latest RMIS Dashboard update: August 2021.

## 52.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2017.

Notes: The indicator is calculated from background data provided by the source in line with the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020)

Latest RMIS Dashboard update: August 2021.

## 52.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 53 Neodymium

### 53.1 Resources and Reserves

Data are unavailable (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### 53.2 Production of primary materials

Coverage: World countries (2021), World total (2000-2020)

Time period of compiled data series: 2000-2021

Reference Year: 2021

Data source(s): JRC analysis based on the total REE production and neodymium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of neodymium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### 53.3 Production of refined/processed materials

The collected information is not publicly available.

### 53.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production in 2012-2021.

### 53.5 Applications

Geographical scope: Europe

Data source(s): (Wood Mackenzie, 2022a)

Reference Year: 2021

Notes: Data reflect neodymium's end-use demand.

Latest RMIS Dashboard update: August 2023.

### 53.6 Trade of primary materials

There are no specific codes to neodymium in international trade statistics (HS). Neodymium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).

### **53.7 Trade of refined/processed materials**

There are no specific codes to neodymium in international trade statistics (HS). Neodymium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

### **53.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU28

Data source(s): EC MSA study (BIO by Deloitte, 2015)

Reference Year: 2013

Notes: The indicator is calculated from background data provided by the source according to the methodology outlined in (Peiró *et al.*, 2018).

Latest RMIS Dashboard update: August 2021.

### **53.9 Other Indicators**

- ✓ The EU sourcing (EU supply) originates from (SCREEN2, 2023) and associates to all forms of neodymium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **54 Neon**

### **54.1 Resources and Reserves**

Not applicable. Neon is only present in the air in trace amounts and is recovered as by-product in air separation units.

### **54.2 Production of primary materials**

Not applicable. Neon is obtained from air in air separation units by fractional separation of liquefied air.

### **54.3 Production of refined/processed materials**

#### **54.3.1.1 Neon gas**

Coverage: World total.

Time period of compiled data series: 2000-2017.

Reference Year: 2017.

Data source(s): (Elsner, 2018) .

Other collected/checked/registered datasets: -

Notes: Publicly-available and country-specific data of production are insufficient for having the global distribution by countries.

Latest RMIS Dashboard update: August 2023.

### **54.4 Additional information and insights about production**

- ✓ The rare gas output distribution originates from data reported by (Elsner, 2018);
- ✓ The calculation of CAGR concerns the production of xenon between 2008 and 2017.

### **54.5 Applications**

Geographical scope: World.

Data source(s): (Elsner, 2018) .

Reference Year: 2017.

Notes: Data relate to the distribution of demand by end uses. EU-specific information is missing.

Latest RMIS Dashboard update: August 2023.

### **54.6 Trade of primary materials**

Not applicable.

### **54.7 Trade of refined/processed materials**

No data are available in international trade statistics. The level of detail in the HS nomenclature is inadequate to identify trade flows of neon, which is reported in HS 280429 alongside other rare gases.

### **54.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Data to allow the calculation/estimation of the indicator are not available.

### **54.9 Other Indicators**

-



## **55 Nickel**

### **55.1 Resources and Reserves**

#### **55.1.1 Resources**

Coverage: World countries.

Data source(s): JRC elaboration based on (S&P, 2022) and (Mudd and Jowitt, 2022).

Reference Year: 2020.

Notes: Data reported by (Mudd and Jowitt, 2022) for 2018 represent a comprehensive global assessment of reported Ni deposits and projects for the year 2018. Country-by-country data were amended to reflect the estimate of global nickel resources in 2021 reported by (S&P, 2022), taking into account the cumulative nickel mine production 2019-2021 per country. Then, the highest value reported for an individual country between (S&P, 2022) and amended data from (Mudd and Jowitt, 2022) is selected.

Latest RMIS Dashboard update: August 2023

#### **55.1.2 Reserves**

Coverage: World countries.

Data source(s): (S&P, 2022).

Reference Year: 2020.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2021.

### **55.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-Ni, 2023) (2000-2019).

Notes: It is deduced from the various data sources that nickel mine statistics represent the recoverable mine production of nickel or the nickel content of a more highly processed form (as an indication of the magnitude of mine output where actual mine output is not available).

Latest RMIS Dashboard update: August 2023.

### **55.3 Production of refined/processed materials**

#### **55.3.1 Refined nickel(metal, salts, oxide) & ferronickel**

Coverage: World countries.

Time period of compiled data series: 2000-2021

Reference Year: 2021

Data source(s): (BGS, 2023)

Other collected/checked/registered datasets: -

Notes: Smelter/refinery production of nickel. Data relate to refined nickel plus the nickel content of ferro-nickel, nickel oxide and nickel salts. From 2012 onwards data do not include nickel content of nickel hydroxide cake or nickel matte as these are further refined elsewhere.

Latest RMIS Dashboard update: August 2023.

### **55.3.2 Refined nickel(Class I incl. salts & oxide)**

Coverage: World countries.

Time period of compiled data series: 2000-2019.

Reference Year: 2019.

Data source(s): JRC based on (USGS myb-Ni, 2023).

Other collected/checked/registered datasets: (Fraser *et al.*, 2021) (2010-2019).

Notes: Data relate to Class I refined nickel plus the nickel content of nickel oxide and salts from primary sources.

Latest RMIS Dashboard update: August 2023.

### **55.3.3 Ferronickel & nickel pig iron**

Coverage: World countries.

Time period of compiled data series: 2000-2019.

Reference Year: 2019.

Data source(s): JRC based on (USGS myb-Ni, 2023).

Other collected/checked/registered datasets: (BGS, 2023) (2000-2021 in gross weight), (USGS myb-ferroalloys, 2023) (2000-2020 in gross weight).

Notes: Data represent the production of Class II nickel production including ferronickel and nickel pig iron (NPI).

Latest RMIS Dashboard update: August 2023.

### **55.3.4 Nickel sulphate**

Coverage: World total (2010-2019), by world countries (2020).

Time period of compiled data series: 2010-2020.

Reference Year: 2020.

Data source(s): (Fraser *et al.*, 2021).

Other collected/checked/registered datasets: -

Notes: Data refer to primary nickel sulphate produced from intermediates. Additional production from Class I metal or recycled feedstocks is not included.

Latest RMIS Dashboard update: August 2023.

## **55.4 Additional information and insights about production**

- ✓ Nickel's mine production by deposit type is based on JRC analysis and data collection (JRC, 2021);
- ✓ The product mix of Class I nickel is sourced from (Fraser *et al.*, 2021);
- ✓ The distribution of the various feedstocks for the production of nickel sulphate is obtained from (Fraser *et al.*, 2021).
- ✓ The calculation of CAGR is based on the combined refined nickel & ferronickel output (2010-2019).

## **55.5 Applications**

Geographical scope: World.

Data source(s): JRC elaboration based on background data from (Fraser *et al.*, 2021).

Reference Year: 2019.

Notes: Data shown refer to world demand for nickel by first uses, i.e. the conversion of nickel products into intermediate products that form the basis for nickel-containing end-use products. The EC MSA study (Matos, Ciacci, *et al.*, 2020) provides EU-specific data concerning the end uses of nickel by industrial sector in 2016.

Latest RMIS Dashboard update: March 2022.

## 55.6 Trade of primary materials

Coverage: Aggregate of HS 260400, HS 750110 and HS 750120. Except for ores and concentrates (HS 260400), intermediate products of nickel metallurgy (nickel mattes, nickel oxide sinters, crude nickel oxides and others classified in headings HS 750110 and HS 750120) are considered as primary Ni-bearing materials. The trade of nickel intermediates in the form of mixed nickel sulphide precipitate (MSP) in HS 283090 is not included as the heading contains several substances. Moreover, the trade of nickel intermediates in the form of mixed nickel hydroxide precipitate (MHP) captured by HS 282540 is considered in the trade of processed/refined materials as the heading also contains pure nickel oxides and hydroxides. Metallurgical by-products containing nickel classified under HS 262099 are not included due to the code's high aggregation. Finally, the trade of nickel-bearing copper ores & concentrates is also not possible to be captured by international trade statistics.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports of Cuba, Papua New Guinea, New Caledonia and Zimbabwe are estimated from imports reported by trade partners. Iran's and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 260400 *Nickel ores and concentrates*; HS 750110 *Nickel; nickel mattes*; HS 750120 *Nickel; oxide sinters and other intermediate products of nickel metallurgy*.

Latest RMIS Dashboard update: August 2021.

## 55.7 Trade of refined/processed materials

Coverage: The selected commodities representing the aggregated trade of refined/processed nickel are HS 282540 (Nickel oxides and hydroxides), HS 282735 (Nickel chloride), HS 283324 (Nickel sulphate), HS 720260 (Ferronickel), HS 750210 (Unwrought nickel, consisting of unrefined anodes and refined nickel cathodes and other refined forms such as briquettes), HS 750220 (Unwrought nickel alloys), and HS 750400 (Nickel powders). Trade of nickel pig iron (NPI) covered by HS 720150 is excluded as the HS heading contains several forms of alloy pig iron.

Data source(s): (WITS, 2021).

Reference Year: August 2021.

Notes: Exports of New Caledonia, Cuba and Myanmar, are obtained from reported imports by destination countries. Dominican Republic's, Mozambique's, Iran's and Ukraine's trade for 2019 is determined from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 282540 *Nickel oxides and hydroxides*; HS 282735 *Chlorides; of nickel*; HS 283324 *Sulphates; of nickel*; HS 720260 *Ferro-alloys; ferro-nickel*; HS 750210 *Nickel; unwrought, not alloyed*; HS 750220 *Nickel; unwrought, alloys*; HS 750400 *Nickel; powders and flakes*

Latest RMIS Dashboard update: August 2021.

## 55.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU.

Data source(s): EC MSA study (Matos, Ciacci, *et al.*, 2020).

Reference Year: 2016.

Notes: The indicator is calculated from background data provided by the source according to the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020).

Latest RMIS Dashboard update: August 2021.

### **55.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **56 Niobium**

### **56.1 Resources and Reserves**

#### **56.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023

#### **56.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023

### **56.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2008-2021, (USGS myb-Nb, 2013) for 2000-2007.

Other collected/checked/registered datasets: (BGS, 2023) (2000-2021), (USGS myb-Nb, 2013) (2008-2021).

Notes: Data refer to concentrates of Nb-bearing minerals, e.g. columbite, tantalite, pyrochlore.

Latest RMIS Dashboard update: August 2023.

### **56.3 Production of refined/processed materials**

#### **56.3.1 Processed Nb products**

Coverage: World total.

Time period of compiled data series: 2009-2018.

Reference Year: 2018.

Data source(s): (TIC, 2020).

Other collected/checked/registered datasets: -

Notes: Niobium products shipments by processors.

Latest RMIS Dashboard update: August 2023.

#### **56.3.2 Ferroniobium**

Coverage: World countries

Time period of compiled data series: 2000-2021

Reference Year: 2021

Data source(s): JRC elaboration based on (BGS, 2023) for 2000-2002, (USGS myb-ferroalloys, 2023) for 2003-2020, (USGS myb-Nb, 2022) for 2021, (Eurostat Prodcum, 2023b) for 2019-2021.

Other collected/checked/registered datasets: (TIC, 2020) (2009-2018), (BGS, 2023) (2003-2021), (USGS myb-Nb, 2022) (2004-2020), (BIO by Deloitte, 2015) (2013).

Notes: Figures are associated to ferroniobium that represents about 90% of total refinery production. The total EU production in 2019-2021 is derived from (Eurostat Prodcum, 2023b); in 2013, it is sourced from (BIO by Deloitte, 2015), whereas in 2012 and 2014-2018 is a JRC estimate..

Latest RMIS Dashboard update: August 2023.

## 56.4 Additional information and insights about production

- ✓ Information on the shipments of processed niobium products is obtained from (TIC, 2020);
- ✓ The CAGR is calculated on the basis of primary (mine) production between 2012 and 2021.

## 56.5 Applications

Geographical scope: World.

Data source(s): (CBMM, 2019).

Reference Year: 2018.

Notes: Figures represent sales by end-use industrial sector as reported by the largest producer in the world in equivalent units of ferro-niobium. Published EU-specific data are missing and these figures are assessed as applicable to the EU.

Latest RMIS Dashboard update: August 2021.

## 56.6 Trade of primary materials

The trade of niobium-bearing concentrates and niobium-rich metallurgical slags and residues cannot be distinguished in the HS nomenclature as the relevant HS headings (HS 261590, HS 262099) do not have the required granularity.

## 56.7 Trade of refined/processed materials

Coverage: Data refer to HS 720293 that entails the trade of ferroniobium. Trade of niobium metal and other niobium compounds such as niobium oxides is not included due to the high level of aggregation with other commodities in the relevant HS headings (HS 811292, HS 282590).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's and Ukraine's trade for 2019 originates from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 720293 *Ferro-alloys; ferro-niobium*.

Latest RMIS Dashboard update: August 2021.

## 56.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2013.

Notes: The indicator is calculated from background data provided by the source according to the methodology described in (Peiró *et al.*, 2018). It is noted that the study considered recycling of Nb-containing steels as non-functional. An alternative estimate for the EOL-RIR is 25% (ranging from 12% to 50%), derived according to the guidance provided in the methodology for establishing the EU List of Critical Raw Materials (Blengini *et al.*, 2017) and data from (UNEP, 2011). The EOL-RIR is approximated by the median recycled content (RC) and the median old scrap ratio (OSR) of the ranges reported by (UNEP, 2011) (35% is assumed for OSR and 75% for RC in the estimation).

Latest RMIS Dashboard update: August 2021.

## 56.9 Other

- ✓ The EU sourcing (EU supply) and the Import Reliance are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **57 Ornamental and building stones**

### **57.1 Resources and Reserves**

Comprehensive data at country level are not available for the various ornamental and building stones. World resources and reserves are adequate but can be limited on a local or regional level for certain special types of stones (USGS, 2023).

### **57.2 Production of primary materials**

Coverage: By EU countries (partial).

Time period of compiled data series: 2008-2021.

Reference Year: 2021.

Data source: (Eurostat Prodc, 2023a).

Other data sources checked and/or compiled: -

Notes: The Ornamental and building stones (crude, roughly trimmed, simply cut, or in rough blocks and slabs) analysed are: quartzite, slate, marble and travertine, granite, sandstone, ecaussine, alabaster, porphyry, basalt and other monumental or building stones. PRC codes used: 08111290, 08114000, 08111133, 08111136, 08111150, 08111233, 08111236, 08111250, 08111290, 08111220, 08111260. As production figures reported by Prodc are withheld for some EU countries in each year, JRC estimated the missing values (by interpolation) in order to complete the dataset for specific EU countries. When reasonable estimates were not possible from the existing production figures or when production figures are withheld for each year for individual EU countries, the production of these countries is included in 'Other EU'.

Latest RMIS Dashboard update: August 2023.

### **57.3 Production of refined/processed materials**

#### **57.3.1 Worked ornamental and building stones (all stones)**

Coverage: EU total.

Time period of compiled data series: 2003-2020.

Reference Year: 2020.

Data source: (Eurostat Prodc, 2023a).

Other data sources checked and/or compiled: -

Notes: The product aggregate covers various stones used in construction and decoration that have been worked beyond the stage of the normal quarry products, i.e. further processed than mere shaping into blocks, sheets or slabs by splitting, roughly cutting or squaring, or squaring by sawing. The stones considered comprise: quartzite, slate, marble, travertine, alabaster granite, slate, natural stones and other undifferentiated stones. PRC codes used: PRC 23701100, 23701210, 23701230, 23701260, 23701270, 23701280.

Latest RMIS Dashboard update: August 2023.

#### **57.3.2 Worked granite**

Coverage: By EU countries (partial)

Time period of compiled data series: 2003-2020

Reference Year: 2020

Data source: (Eurostat Prodc, 2023a)

Other data sources checked and/or compiled: -

Notes: Data concern processed articles of granite. PRC code used: 23701260. Production data provided by Prodc are withheld for some EU countries in each year, thus, JRC estimated the missing values (by interpolation) in order to complete the



dataset for specific EU countries. When reasonable estimates were not possible from the reported production figures or when production figures are withheld for each years for individual EU countries, the production of these countries is included in 'Other EU'.

Latest RMIS Dashboard update: August 2023.

### **57.3.3 Worked marble, travertine and alabaster**

Coverage: By EU countries (partial).

Time period of compiled data series: 2003-2020.

Reference Year: 2020.

Data source: (Eurostat Prodcom, 2023a).

Other data sources checked and/or compiled: -

Notes: Data relate to processed articles of marble, travertine and alabaster. PRC code used: 23701100. Production figures provided by Prodcom are withheld for some EU countries in each year; therefore, missing values were estimated (by interpolation) in order to complete the gaps for specific EU countries. When reasonable estimates were not possible from the reported production figures or when production figures are withheld for each years for individual EU countries, the production of these countries is included in 'Other EU'.

### **57.3.4 Latest RMIS Dashboard update: August 2023.**

#### **57.3.4.1 Worked slate**

Coverage: By EU countries (partial).

Time period of compiled data series: 2003-2020.

Reference Year: 2020.

Data source: (Eurostat Prodcom, 2023a).

Other data sources checked and/or compiled: -

Notes: Data relate to processed articles of slate (roofing and wall slate). PRC code used: 23701280. As production figures reported by Prodcom are withheld for some EU countries in each year, JRC estimated the missing values (by interpolation) in order to complete the dataset for specific EU countries. When reasonable estimates were not possible from the reported production figures or when production figures are withheld for each years for individual EU countries, the production of these countries is included in 'Other EU'.

Latest RMIS Dashboard update: August 2023.

#### **57.3.4.2 Worked natural stone**

Coverage: By EU countries (partial).

Time period of compiled data series: 2003-2020

Reference Year: 2020.

Data source: (Eurostat Prodcom, 2023a).

Other data sources checked and/or compiled: -

Notes: Data concern setts, kerbstones and flagstones (excluding of slate) and other processed articles (tiles, cubes and other) of natural stone (including slate). PRC codes used: 23701210, 23701230. As production figures reported by Prodcom are withheld for some EU countries in each year, JRC estimated the missing values (by interpolation) in order to complete the dataset for specific EU countries. When reasonable estimates were not possible from the existing production figures or when production figures are withheld for each years for individual EU countries, the production of these countries is included in 'Other EU'.

Latest RMIS Dashboard update: August 2023.

### **57.3.5 Worked Ornamental and Building stones (other)**

Coverage: By EU countries (partial).

Time period of compiled data series: 2003-2020.

Reference Year: 2020.

Data source: (Eurostat Prodcom, 2023a).

Other data sources checked and/or compiled: -

Notes: Data comprise processed articles of calcareous and other stones (PRC code 23701270). As production figures reported by Prodcom are withheld for some EU countries in each year, JRC estimated the missing values (by interpolation) in order to complete the dataset for specific EU countries. When reasonable estimates were not possible from the existing production figures or when production figures are withheld for each year for individual EU countries, the production of these countries is included in 'Other EU'.

Latest RMIS Dashboard update: August 2023.

## 57.4 Additional information and insights about production

- ✓ The distribution of production by stone of crude or roughly worked ornamental and building stones is derived from (Eurostat Prodcom, 2023a);
- ✓ The distribution of production by stone of worked ornamental and building stones is based on data from (Eurostat Prodcom, 2023a);
- ✓ The CAGR refers to the production of primary materials (crude, roughly trimmed, simply cut, or in rough blocks and slabs) in 2012-2021.

## 57.5 Applications

Geographical scope: Europe.

Data source: JRC estimate.

Reference Year: NA

Notes: The estimate is relevant to the end-use market(s).

Latest RMIS Dashboard update: August 2023.

## 57.6 Trade of primary materials

Coverage: Aggregate of HS 250620, HS 251400, HS 251511, HS 251512, HS 251520, HS 251611, HS 251612, HS 251620, and HS 251690.

Data source: (WITS, 2023)

Reference Year: 2023

Notes: -

Relevant Harmonized System (HS) Codes:

HS 250620 *Quartzite; whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape;*

HS 251400 *Slate; whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape;*

HS 251511 *Marble and travertine; having a specific gravity of 2.5 or more, crude or roughly trimmed by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape;*

HS 251512 *Marble and travertine; merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape, having a specific gravity of 2.5 or more;*

HS 251520 *Ecaussine and other calcareous monumental or building stone; alabaster, having a specific gravity of 2.5 or more;*

HS 251611 *Granite; crude or roughly trimmed;*

HS 251612 *Granite; merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape;*

HS 251620 *Sandstone; whether or not roughly trimmed, cut, by sawing etc, into blocks or slabs of a rectangular (including square) shape;*

HS 251690 *Monumental or building stone; n.e.c. in heading no. 2516, whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a rectangular (including square) shape.*

Latest RMIS Dashboard update: August 2023.

## **57.7 Trade of refined/processed materials**

Coverage: Aggregate of HS 680100, HS 680210, HS 680221, HS 680223, HS 680229, HS 680291, HS 680292, HS 680293, HS 680299, HS 680299, HS 680300, and HS 680300.

Data source: (WITS, 2023)

Reference Year: 2023

Notes:

Relevant Harmonized System (HS) Codes:

HS 680100 *Stone; setts, curbstones and flagstones, of natural stone (except slate);*

HS 680210 *Tiles, cubes and similar articles; whether or not rectangular (including square), largest surface area of which is capable of being enclosed in square, side less than 7cm, coloured granules, chippings, powder;*

HS 680221 *Marble, travertine and alabaster; simply cut or sawn, with a flat or even surface;*

HS 680223 *Granite; articles thereof, simply cut or sawn, with a flat or even surface;*

HS 680229 *Stone; monumental or building stone, n.e.c. in item no. 6802.2, articles thereof, simply cut or sawn, with a flat or even surface;*

HS 680291 *Marble, travertine and alabaster; articles thereof, (other than simply cut or sawn, with a flat or even surface);*

HS 680292 *Stone; calcareous (excluding marble, travertine, alabaster) articles thereof, (other than simply cut or sawn, with a flat or even surface);*

HS 680293 *Granite; articles thereof, (other than simply cut or sawn, with a flat or even surface);*

HS 680299 *Stone; natural (excluding marble, travertine, alabaster, other calcareous stone or granite), monumental or building stone, (other than simply cut or sawn, with a flat or even surface);*

HS 680300 *Slate, worked; and articles of slate or of agglomerated slate.*

Latest RMIS Dashboard update: August 2023.

## **57.8 End-of-Life Recycling Input Rate (EOL-RIR)**

There is insufficient information to calculate the EOL-RIR in the EU.

## **57.9 Other Indicators**

- ✓ The Ornamental and building stones were not screened in the 2023 assessment of critical raw materials for the EU (European Commission, 2023); thus, no figures are displayed for EU sourcing (EU supply) and Import Reliance.



## **58 Palladium**

### **58.1 Resources and Reserves**

#### **58.1.1 Resources**

Data source(s): (S&P, 2022)

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards

Latest RMIS Dashboard update: August 2023.

#### **58.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **58.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (JM, 2019a) (2000-2013), (JM, 2019b) (2014-2016), (JM, 2022) (2017-2021), (Heraeus-SFA Oxford, 2022) (2018-2021), (USGS myb-PGM, 2023) (2000-2021), (WMD, 2023) (2006-2021).

Notes: Production figures are allocated to where the initial mining took place rather than the location of refining. Russia's production comprises includes sales from stocks.. Data for Australia are sourced from (WMD, 2023).

Latest RMIS Dashboard update: August 2023.

### **58.3 Production of refined/processed materials**

#### **58.3.1 Refined palladium**

Coverage: World total.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): Data for palladium's primary production and data for secondary production from (JM, 2019a) for 2000-2013, (JM, 2019b) for 2014-2016, and (JM, 2022) for 2017-2021.

Other collected/checked/registered datasets: (Heraeus-SFA Oxford, 2022) (2018-2021)

Notes: Figures refer to the total production of palladium (primary & secondary). The primary metallurgical production is almost identical to mining production (mine producers report metallurgically produced palladium or palladium payable, therefore recoverable). Secondary production (supply) is the quantity of metal recovered from open-loop recycling; closed-loop recycling is excluded.

Latest RMIS Dashboard update: August 2023.

### 58.3.2 Refined palladium products

Coverage: EU countries.

Time period of compiled data series: 2011-2021.

Reference Year: 2021.

Data source(s): JRC estimate based on (Eurostat Prodcum, 2023a) and (Eurostat Comext, 2022).

Other collected/checked/registered datasets: -

Notes: The products relate to palladium unwrought & powder (PRC code 24413015 *Palladium. Unwrought or in powder form*) that covers palladium metal and alloys in which palladium predominates by weight. The production in Germany in 2019-2020 is sourced from (Eurostat Prodcum, 2023a); for 2011-2018 it was estimated from aggregated data for all PGM as reported by (Eurostat Prodcum, 2023a). The production in Belgium is approximated on the basis of operating capacity (25 kt per year) and the assumption that it followed yearly the trend of global demand. Exports (EU-intra and EU-extra) are used as a proxy for the production in the rest of countries (Italy, Austria, Czechia, France, Netherlands, Spain) after accounting for re-exports.

### 58.4 Additional information and insights about production

- ✓ The refinery production by source is based on the associated data for primary and secondary production;
- ✓ The CAGR refers to refinery production (primary & secondary) between 2012 and 2021.

### 58.5 Applications

Geographical scope: Europe.

Data source(s): Data are obtained from (Johnson Matthey, 2022).

Reference Year: 2021.

Notes: The distribution of demand relates to end-use applications/industrial segments. Investment is excluded as negative in 2021 in Europe.

Latest RMIS Dashboard update: August 2023.

### 58.6 Trade of primary materials

The HS nomenclature does not provide the required detail for tracing the trade of PGM-bearing ores and concentrates in HS 261690; the code is entirely allocated to gold ores and concentrates in RMIS database.

### 58.7 Trade of refined/processed materials

Coverage: Trade data cover palladium, unwrought or in powder form (HS 711021). Trade of palladium compounds reported under HS 284390 is not included as compounds of other metals are also classified within the heading. Trade of wrought palladium and its alloys, in semi-manufactured forms, is excluded (HS 711029).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Ukraine's trade for 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 711021 *Metals; palladium, unwrought or in powder form*.

Latest RMIS Dashboard update: August 2021.

## **58.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: World.

Data source(s): JRC calculation based on data from (Johnson Matthey, 2022).

Reference Year: 2021.

Notes: The EOL-RIR is derived as total recycling (from autocatalysts, electronics, and jewellery) divided by the total input of material consisting of primary supply, recycling and movement in stocks (gross demand). Closed-loop recycling is not included. It is assumed that the figure of the EOL-RIR is applicable in the EU.

Latest RMIS Dashboard update: November 2022.

## **58.9 Other Indicators**

- ✓ The EU sourcing (EU supply) for the extraction stage (primary materials) is derived from (SCRREEN2, 2023) and (European Commission, 2023). It represents the average global supply in 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **59 Perlite**

### **59.1 Resources and Reserves**

#### **59.1.1 Resources**

Estimates of perlite's global resources are not available.

#### **59.1.2 Reserves**

Available data are limited and have a partial country coverage; therefore, no figures are displayed for perlite's global reserves.

### **59.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (WMD, 2023) for 2006-2021, (USGS myb-perlite, 2022) (2000-2021).

Notes: Data relate to perlite production.

Latest RMIS Dashboard update: August 2023.

### **59.3 Production of refined/processed materials**

Information is scarce on the production of expanded perlite.

### **59.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production in 2012-2021.

### **59.5 Applications**

Geographical scope: Europe.

Data source(s): Data provided by IMA Europe (2016) in (European Commission, 2017b).

Reference Year: NA

Notes: Figures demonstrate end-use market shares. Data for miscellaneous uses are missing from the dataset.

Latest RMIS Dashboard update: August 2021.

### **59.6 Trade of primary materials**

Coverage: Data from heading HS 253010 are used for the estimation of perlite-specific flows.

Data source(s): JRC estimation based on background data from (WITS, 2021)

Reference Year: 2019.

Notes: The split of perlite flows from other materials contained within HS 253010 is achieved after assessing production for perlite and vermiculite reported by the British Geological Survey (BGS, 2021) and unit prices. Iran's, Mozambique's, and Ukraine's trade for 2019 is derived from declared imports and exports by trade partners.



Relevant Harmonized System (HS) Codes: HS 253010 *Vermiculite, perlite and chlorites; unexpanded*.

Latest RMIS Dashboard update: August 2021.

### **59.7 Trade of refined/processed materials**

No data are obtainable from international statistics. The trade of expanded perlite is reported under headings HS 680620 (hollow granules not burst) and HS 380290 (hollow granules burst to concave lamellae), which in addition to perlite contain more expanded or exfoliated mineral products.

### **59.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Recent and robust data allowing the calculation or estimation of perlite's EOL-RIR are missing.

### **59.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **60 Phosphate rock**

### **60.1 Resources and Reserves**

#### **60.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **60.1.2 Reserves**

Data source(s): (USGS, 2023).

Reference Year: 2022.

Notes: Reserves are defined according to the USGS classification system (USGS, 1980).

Latest RMIS Dashboard update: August 2023.

### **60.2 Production of primary materials**

Coverage: World countries

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (USGS myb-phosphate, 2022) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2000-2021) (IFASat, 2023) (2010-2021).

Notes: Data for Canada in 2006-2013 are compiled from (USGS myb-phosphate, 2022).

Latest RMIS Dashboard update: August 2023.

### **60.3 Production of refined/processed materials**

#### **60.3.1 Phosphoric acid**

Coverage: World total.

Time period of compiled data series: 2010-2021.

Reference Year: 2021.

Data source(s): (IFASat, 2023).

Other collected/checked/registered datasets: -

Notes: Country-specific data are not publicly available.

Latest RMIS Dashboard update: August 2023.

#### **60.3.2 Processed phosphates**

Coverage: World countries.

Time period of compiled data series: 2000-2020

Reference Year: 2020.

Data source(s): (IFASat, 2023).

Other collected/checked/registered datasets: -

Notes: Processed phosphate products relate to fertilisers and other industrial products. Data shown on a nutrient basis comprise the aggregate of basic slag, ground phosphate rock directly applicable, single superphosphate, triple superphosphate, other P straight fertilisers, ammonium phosphate (DAP), PK compound fertiliser, other NP compound fertilisers, NPK compound fertilisers.

Latest RMIS Dashboard update: August 2023.

## 60.4 Additional information and insights about production

- ✓ The regional output of phosphoric acid is sourced from (IFASat, 2023);
- ✓ The CAGR refers to primary (mining) production in 2012-2021.

## 60.5 Applications

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: Figures reflect end uses. The disaggregation of industrial uses reported by the source is based on (De Boer *et al.*, 2019).

Latest RMIS Dashboard update: August 2023.

## 60.6 Trade of primary materials

Coverage: Data shown are the aggregate of HS 251010 and HS 251020 involving unground and ground natural phosphates.

Data source(s): (WITS, 2021).

Reference Year: 2021.

Notes: Egypt's exports are deduced from declared imports by trade partners.

Relevant Harmonized System (HS) Codes: HS 251010 *Natural calcium phosphates, natural aluminium calcium phosphates and phosphatic chalk; unground*; HS 251020 *Natural calcium phosphates, natural aluminium calcium phosphates and phosphatic chalk; ground*.

Latest RMIS Dashboard update: August 2021.

## 60.7 Trade of refined/processed materials

Coverage: Data shown are the aggregate of HS codes covering Phosphoric acid, P fertilisers and PN fertilisers.

Data source(s): (WITS, 2023).

Reference Year: 2021.

Notes: -

Relevant Harmonized System (HS) Codes: HS 280920 *Phosphoric acid & polyphosphoric acids, whether/not chemically defined*; HS 310311 *Superphosphates containing by weight => 35 % of diphosphorus pentoxide "P2O5" (excl. such products in tablets or similar forms, or in packages with a gross weight of <= 10 kg)*; HS 310390 *Mineral/chemical fertilisers, phosphatic(excl. of 3103.10)*; HS 310530 *Diammonium hydrogenorthophosphate (diammonium phosphate)*; HS 310540 *Ammonium dihydrogenorthophosphate (monoammonium phosphate) & mixtures thereof with diammonium hydrogenorthophosphate (diammonium phosphate)*.

Latest RMIS Dashboard update: August 2023.

## **60.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: The EOL-RIR is calculated from background data provided by the source according to the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020). The indicator illustrates the recycling of biogenic waste flows (e.g., food waste, vegetal waste, manure, sludges) that substitute the use of mineral phosphate fertilisers (i.e. primary input material).

Latest RMIS Dashboard update: August 2021.

## **60.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 61 Phosphorus

### 61.1 Resources and Reserves

The raw material for phosphorus production is phosphate minerals (see **Phosphate rock**).

### 61.2 Production of primary materials

Phosphate rock is the raw material for the production of elemental phosphorus (see **Phosphate rock**).

### 61.3 Production of refined/processed materials

#### 61.3.1 Yellow phosphorus

Coverage: World countries.

Time period of compiled data series: 2013-2018.

Reference Year: 2018.

Data source(s): CCM (2018) in (European Commission, 2020a) for 2013, JRC estimate based on (HDIN Research, 2019) for 2014-2018, (Statista, 2022b) for Vietnam's production.

Other collected/checked/registered datasets: -

Notes: Information regarding the production of elemental phosphorus (P<sub>4</sub>) is scarce in the public domain.

Latest RMIS Dashboard update: August 2023.

### 61.4 Additional information and insights about production

- ✓ The production capacity by country is reported by (HDIN Research, 2019).

### 61.5 Applications

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2018 .

Notes: Data concern the end uses of phosphorus (P<sub>4</sub>).

Latest RMIS Dashboard update: August 2021.

### 61.6 Trade of primary materials

No data are shown in terms of phosphorous primary materials. Phosphorus is obtained by treating mineral phosphates in electric furnaces, and phosphate rock is classified in headings HS 251010 and HS 251020. However, trade data in the HS nomenclature do not make a distinction between mineral phosphates destined for phosphorous production from those employed in fertilisers and/or other uses.

### 61.7 Trade of refined/processed materials

Coverage: Data from HS 280470 are employed covering the trade of elemental phosphorous (white and red). Phosphorous chemicals such as phosphorus chlorides (HS 281213), phosphoric acid (thermal process) and polyphosphoric acids (HS 280920), hypophosphites and other compounds derived from elemental phosphorous are not included.

Data source(s): (WITS, 2021)

Reference Year: 2019.

Notes: Iran's and Ukraine's trade for 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 280470 *Phosphorus*.

Latest RMIS Dashboard update: August 2021.

### **61.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2017.

Notes: The indicator is calculated from background data reported by the source according to the methodology outlined in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020).

Latest RMIS Dashboard update: August 2021.

### **61.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **62 Platinum**

### **62.1 Resources and Reserves**

#### **62.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **62.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **62.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (JM, 2019a) (2000-2013), (JM, 2019b) (2014-2016), (JM, 2022) (2017-2021), (Heraeus-SFA Oxford, 2022) (2018-2021), (WPIC, 2022) (2014-2021), (USGS myb-PGM, 2023) (2000-2021), (WMD, 2023) (2006-2021).

Notes: Production figures are allocated to where the initial mining took place rather than the location of refining.

Latest RMIS Dashboard update: August 2023.

### **62.3 Production of refined/processed materials**

#### **62.3.1 Refined platinum**

Coverage: World total.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): Data for platinum's primary production and data for secondary production from (JM, 2019a) for 2000-2013, (JM, 2019b) for 2014-2016, and (JM, 2022) for 2017-2021.

Other collected/checked/registered datasets: (Heraeus-SFA Oxford, 2022) (2018-2021), (WPIC, 2022) (2014-2021).

Notes: Figures refer to the total production of platinum (primary & secondary). The primary metallurgical production is almost identical to mining production (mine producers report metallurgically produced platinum or platinum payable, therefore recoverable). Secondary production (supply) is the quantity of metal recovered from open-loop recycling; closed-loop recycling is excluded.

Latest RMIS Dashboard update: August 2023.

### 62.3.2 Refined platinum products

Coverage: EU countries.

Time period of compiled data series: 2011-2021.

Reference Year: 2021.

Data source(s): JRC estimate based on (Eurostat Prodcum, 2023a) and (Eurostat Comext, 2022).

Other collected/checked/registered datasets: -

Notes: The products relate to platinum unwrought & powder (PRC code 24413010 *Platinum. Unwrought or in powder form*) that comprises platinum metal and alloys in which platinum predominates by weight. The production in Germany in 2019-2020 is sourced from (Eurostat Prodcum, 2023a); for 2011-2018 it was estimated from aggregated data for all PGM as reported by (Eurostat Prodcum, 2023a). The production in Belgium is approximated on the basis of operating capacity (25 kt per year) and the assumption that it followed the trend of global demand. Exports (EU-intra and EU-extra) are used as a proxy for the output in other producing countries (Italy, Austria, Czechia, France, Ireland) after accounting for re-exports.

### 62.4 Additional information and insights about production

- ✓ The refinery production by source is based on the associated data for primary and secondary production;
- ✓ The CAGR refers to refinery production (primary & secondary) between 2012 and 2021.

### 62.5 Applications

Geographical scope: Europe.

Data source(s): Data are collected from (Johnson Matthey, 2022).

Reference Year: 2021.

Notes: Data show the distribution of demand by end-use applications/industrial segments.

Latest RMIS Dashboard update: August 2023.

### 62.6 Trade of primary materials

The HS nomenclature does not provide the required detail for tracing the trade of PGM-bearing ores and concentrates in HS 261690; the code is entirely allocated to gold ores and concentrates in RMIS database.

### 62.7 Trade of refined/processed materials

Coverage: Trade data cover platinum, unwrought or in powder form (HS 711011). Trade of colloidal platinum and platinum compounds reported under HS 284310 and HS 284390, respectively, is not included as compounds of other metals are also classified within these headings. Trade of wrought platinum and its alloys, in semi-manufactured forms, is excluded (HS 711019).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Ukraine's trade for 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 711019 *Metals; platinum, unwrought or in powder form*

Latest RMIS Dashboard update: August 2021.



## **62.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: World.

Data source(s): JRC calculation based on (Johnson Matthey, 2022).

Reference Year: 2021.

Notes: The EOL-RIR is derived as total recycling (from autocatalysts, electronics, and jewellery) divided by the total input of material consisting of primary supply, recycling and movement in stocks (gross demand). Closed-loop recycling is not included. It is hypothesised that the figure of the indicator is also relevant for the EU.

Latest RMIS Dashboard update: November 2022

## **62.9 Other Indicators**

- ✓ The EU sourcing (EU supply) for the extraction stage (primary materials) is derived from (SCRREEN2, 2023) and (European Commission, 2023). It represents the average global supply in 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **63 Platinum-Group Metals (PGM)**

### **63.1 Resources and Reserves**

#### **63.1.1 Resources**

Data source(s): (Mudd *et al.*, 2018).

Reference Year: 2015.

Notes: The detailed dataset originates from a comprehensive global assessment of PGM resources and reserves on an individual project basis. Almost all reported reserves and resources are code-compliant.

Latest RMIS Dashboard update: August 2021

#### **63.1.2 Reserves**

Data source(s): (Mudd *et al.*, 2018).

Reference Year: 2015.

Notes: The detailed dataset originates from a comprehensive global assessment of PGM resources and reserves on an individual project basis. Almost all reported reserves and resources are code-compliant.

Latest RMIS Dashboard update: August 2021.

### **63.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2020.

Reference Year: 2020.

Data source(s): JRC estimation based on.

Other collected/checked/registered datasets:

Notes: Production figures are allocated to where the initial mining took place rather than the location of refining.

Latest RMIS Dashboard update: August 2023.

### **63.3 Production of refined/processed materials**

#### **63.3.1 Refined Platinum-Group Metals**

Coverage: World total.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): Sources used for the compilation of primary and secondary production of platinum, palladium, and rhodium, and the primary production of ruthenium and iridium.

Other collected/checked/registered datasets: -

Notes: Figures represent the total aggregated production of platinum-group metals (primary & secondary). The primary metallurgical production is almost identical to mining production (mine producers report metallurgically produced PGM payable, therefore recoverable). Secondary production (supply) is the quantity of metal recovered from open-loop recycling; closed-loop recycling is excluded.

Latest RMIS Dashboard update: August 2023.

### **63.4 Additional information and insights about production**

- ✓ The breakdown of PGM primary production by metal is derived from data for each element;
- ✓ The refined PGM production by source is derived from data for each element (except for the secondary production of iridium and ruthenium);
- ✓ The CAGR refers to refinery production (primary & secondary) between 2012 and 2021.

### **63.5 Applications**

Geographical scope: World.

Data source(s): Data are sourced from (Johnson Matthey, 2022).

Reference Year: 2021.

Notes: Data show the distribution of demand by end-use sector.

Latest RMIS Dashboard update: August 2023.

### **63.6 Trade of primary materials**

The HS nomenclature does not provide the required detail for tracing the trade of PGM-bearing ores and concentrates in HS 261690; the code is entirely allocated to gold ores and concentrates in RMIS database.

### **63.7 Trade of refined/processed materials**

Coverage: Data consist of the product aggregate of HS 711011, HS 711021, HS 711031, and HS 711041 covering platinum, palladium, rhodium, iridium and ruthenium in unwrought or in powder form. The trade of PGM in colloidal form and the trade of PGM compounds reported under HS 284310 and 284390, respectively, is not included as compounds of other precious metals are also classified within these headings. Wrought PGM and their alloys in semi-manufactured forms is excluded.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's, Mozambique's and Ukraine's trade for 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 711011 Metals; platinum, unwrought or in powder form; HS 711021 Metals; palladium, unwrought or in powder form; HS 711031 Metals; rhodium, unwrought or in powder form; HS 711041 Metals; iridium, osmium, ruthenium, unwrought or in powder form.

Latest RMIS Dashboard update: August 2021.

### **63.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: World.

Data source(s): JRC calculation based on data from (Johnson Matthey, 2022).

Reference Year: 2021.

Notes: The EOL-RIR is calculated from combined data for platinum (see 62.8), palladium (see 58.8), and rhodium (see 70.8). Data of similar coverage and quality are unavailable for ruthenium (see 71.8) and iridium (see 35.8); therefore, iridium and ruthenium are excluded for the overall calculation of the indicator. The indicator is derived as the ratio of total recycling from post-consumer products to the total input of material that consists of primary supply, recycling and movement in stocks (gross demand). Closed-loop recycling is not covered in the data. It is assumed that the figure is also appropriate for the EU.

Latest RMIS Dashboard update: November 2022.

### **63.9 Other Indicators**

- ✓ The Import Reliance is sourced from (European Commission, 2023). It is allocated to the extraction stage and refers to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **64 Potash**

### **64.1 Resources and Reserves**

#### **64.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards

Latest RMIS Dashboard update: August 2023.

#### **64.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **64.2 Production of primary materials**

Coverage: World countries.

Reference Year: 2021.

Time period of compiled data series: 2000-2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-potash, 2022) (2014-2020).

Notes: Data relate to concentrates of various forms of potash and potassium-rich minerals such as potassium chloride, potassium sulphate, potassium nitrate and crude chloride salts (e.g. carnallite, sylvite).

Latest RMIS Dashboard update: August 2023.

### **64.3 Production of refined/processed materials**

#### **64.3.1 Processed potash products**

Coverage: World countries.

Time period of compiled data series: 2000-2020.

Reference Year: 2020.

Data source(s): (IFASat, 2023).

Other collected/checked/registered datasets: -

Notes: Data reported on a nutrient basis are associated with straight & compound potassium-related fertilisers, as well as products for animal feed and industrial uses. Potash products covered include muriate of potash (MOP) (potassium chloride), sulphate of potash (SOP) (potassium sulphate), PK compounds, NK compounds, NPK compounds, and other K straight fertilisers.

Latest RMIS Dashboard update: August 2023.

## 64.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production in 2012-2021.

## 64.5 Applications

Geographical scope: World .

Data source(s): JRC elaboration based on background data from IFAStat (Georgitzikis and D'Elia, 2022).

Reference Year: 2019.

Notes: Country data for the EU consumption are not publicly available. The distribution of global consumption by end uses is assessed to be applicable also to the EU.

Latest RMIS Dashboard update: April 2022.

## 64.6 Trade of primary materials

Coverage: Trade data refer to the aggregate of HS 283421, HS 310420, HS 310430 and HS 310490, covering potassium nitrate, potassium chloride, potassium sulphate and other potassic salts. Potassium sulphate (HS 310430) is taken into account even though it can be also synthesised by treating potassium chloride. The aggregate also includes HS 310490 containing, among others, crude natural potassium salts.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Mozambique's, Iran's, Guyana's, and Ukraine's trade for 2019 is deduced from reported imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 283421 *Nitrates; of potassium*; HS 310420 *Fertilizers, mineral or chemical; potassic, potassium chloride*; HS 310430 *Fertilizers, mineral or chemical; potassic, potassium sulphate*; HS 310490 *Fertilizers, mineral or chemical; potassic, n.e.c. in heading no. 3104*.

Latest RMIS Dashboard update: August 2021.

## 64.7 Trade of refined/processed materials

-

## 64.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: World.

Data source(s): Expert opinion in (European Commission, 2014b)(European Commission, 2017b)(European Commission, 2020b) .

Reference Year: NA

Notes: No data are available for the calculation or estimation of the indicator. As there is no evidence of potash recycling, the EOL-RIR of potash is expected 0% globally and in the EU.

Latest RMIS Dashboard update: August 2021.

## **64.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 65 Praseodymium

### 65.1 Resources and Reserves

No data have been gathered (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### 65.2 Production of primary materials

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and praseodymium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of praseodymium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### 65.3 Production of refined/processed materials

The gathered information is not publicly available.

### 65.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 65.5 Applications

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data correspond with praseodymium's demand by end use.

Latest RMIS Dashboard update: August 2023.

### 65.6 Trade of primary materials

There are no specific codes to praseodymium in international trade statistics (HS). Praseodymium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).



### **65.7 Trade of refined/processed materials**

There are no specific codes to praseodymium in international trade statistics (HS). Praseodymium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

### **65.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Data to calculate or estimate praseodymium's EOL-RIR in the EU are missing.

### **65.9 Other Indicators**

- ✓ The EU sourcing (EU supply) is sourced from (SCRREEN2, 2023) and relates to all forms of praseodymium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 66 Pumice

### 66.1 Resources and Reserves

Quantitative estimates of resources and reserves by world countries are not available. Vast resources have been identified on all continents (USGS, 2023).

### 66.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021

Reference Year: 2021

Data source: (USGS myb-pumice, 2022)

Other data sources checked and/or compiled: -

Notes: Data cover the production of pumice and pumice-like materials (pozzolan, volcanic tuff & cinder, trass).

Latest RMIS Dashboard update: August 2023.

### 66.3 Production of refined/processed materials

Not applicable.

### 66.4 Additional information and insights about production

- ✓ The production distribution by pumicite material is sourced from (USGS myb-pumice, 2022);
- ✓ The CAGR refers to primary (mining) production between 2012 and 2021.

### 66.5 Applications

Geographical scope: United States.

Data source: (USGS myb-pumice, 2022).

Reference Year: 2022.

Notes: Data reflect end-use market shares. EU-specific data are missing; therefore, it is presumed that the shares are also applicable to the EU.

Latest RMIS Dashboard update: August 2023.

### 66.6 Trade of primary materials

Coverage: Data from heading HS 251310 are used, which represent the trade of pumice stone. No trade data are available for related pumicite materials (such as volcanic tuff, pozzolan, trass and similar) due to the high aggregation of the corresponding HS heading (HS 253090) with several mineral products.

Data source: (WITS, 2023).

Reference Year: 2021.

Notes:

Relevant Harmonized System (HS) Codes: HS 251310 *Pumice stone, whether or not heat treated.*

Latest RMIS Dashboard update: August 2023.

### **66.7 Trade of refined/processed materials**

Not applicable.

### **66.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Available information to calculate the EOL-RIR in the EU is inadequate.

### **66.9 Other Indicators**

- ✓ Information about the EU sourcing (EU supply) and the Import Reliance is not displayed as pumice was not included in the 2023 EU assessment of Critical raw materials (European Commission, 2023).

## **67 Rare Earth Elements (REE)**

### **67.1 Resources and Reserves**

#### **67.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **67.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are typically compliant with CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **67.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC compilation based on (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-REE, 2022) (2000-2019), (USGS, 2022) (2020), (USGS, 2023) (2021), (S&P, 2023) (2000-2021).

Notes: Data refer to the world mine production of rare earth concentrates. For the formulation of a more comprehensive estimate for the output level, the dataset is complemented with data for Thailand (2009-2021), Vietnam (2010-2021), and Kyrgyzstan (2000-2003) from USGS, and data for Brazil (2000-2002) and the US (2005-2011, 2020-2021) from (S&P, 2022). The undocumented production in China is not quantified by the various data sources.

Latest RMIS Dashboard update: August 2023.

### **67.3 Production of refined/processed materials**

#### **67.3.1 Refined REE**

Coverage: World countries.

Time period of compiled data series: 2021.

Reference Year: 2021.

Data source(s): JRC elaboration from (Wood Mackenzie, 2022b).

Other collected/checked/registered datasets: -

Notes: Data aggregate the estimated refinery production of cerium, dysprosium, erbium, europium, gadolinium, holmium, lanthanum, lutetium, neodymium, praseodymium, samarium, terbium, thulium, yttrium, and ytterbium. Recycling is included.

Latest RMIS Dashboard update: August 2023.

## 67.4 Additional information and insights about production

- ✓ The estimate for the repartition of REE mine production by element is based on JRC analysis;
- ✓ The breakdown of refined REE production by source is derived from (Wood Mackenzie, 2022b);
- ✓ The CAGR refers to primary (mining) production from 2012 to 2021.

## 67.5 Applications

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data demonstrate the distribution of demand by end use.

Latest RMIS Dashboard update: August 2023.

## 67.6 Trade of primary materials

Coverage: The heading HS 284690 is assigned as a proxy for primary materials of REE. It contains oxides and salts of REE or their mixtures, excluding reduced metal and alloys, which are derived generally at the first stages of metallurgical processing (intermediate products). However, it is noted that the heading may contain purified rare earth oxides which cannot be considered as, similar to the mixed REE compounds, intermediate products but as refined REE products, as long as the final separation into single rare earth compounds has been achieved (Machacek and Kalvig, 2016).

The trade of natural compounds of rare earth metals in the form of ores and concentrates e.g. bastnaesite, xenotime, gadolinite etc. is reported under heading HS 253090 aggregated with other minerals. Similarly, trade of monazite (used for the extraction of thorium and/or rare earth metals) is reported under heading HS 261220 aggregated with other compounds; therefore, it is impossible to quantify the trade of REE-bearing concentrated minerals at the detail of the Harmonised System.

Data source(s): (WITS, 2021)

Reference Year: 2019

Notes: Iran's and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 284690 *Compounds, inorganic or organic (excluding cerium), of rare-earth metals, of yttrium, scandium or of mixtures of these metals*

Latest RMIS Dashboard update: August 2021.

## 67.7 Trade of refined/processed materials

Coverage: The heading HS 280530 is employed as representative of the trade of processed/refined REE, which comprises intermixtures/interalloys and/or separated rare-earth metals of high or low purity. HS 284690 may contain purified rare earth oxides and single rare earth compounds for which separation has been achieved (Machacek and Kalvig, 2016); however, in the current exercise it is allocated to primary materials. Cerium's trade is not included (HS 284610).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports of Malaysia refer to declared imports by destination countries. Iran's and Ukraine's trade for 2019 is deduced from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 280530 *Earth-metals, rare; scandium and yttrium, whether or not intermixed or interalloyed*

Latest RMIS Dashboard update: August 2021.

### **67.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No recent and robust data are available to allow the calculation or estimation of the EOL-RIR in the EU. The EOL-RIR worldwide is estimated to be 13% (as the ratio of post-consumer recycling to global supply) in 2021 based on data from (Wood Mackenzie, 2022a); however, it is assessed that the figure is not applicable to the EU.

### **67.9 Other Indicators**

- ✓ The Import Reliance for extraction and processing (primary and refined materials, respectively) are derived from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **68 Rare Earth Elements for magnets**

### **68.1 Resources and Reserves**

No data have been collected (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### **68.2 Production of primary materials**

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC elaboration based on the total REE production (see 67.2)

Other collected/checked/registered datasets: -

Notes: The REE for magnets group involves cerium, dysprosium, gadolinium, neodymium, praseodymium, samarium, and terbium. Figures are the aggregate of the estimated production of the each of the above REE, with the exception of cerium.

Latest RMIS Dashboard update: August 2023.

### **68.3 Production of refined/processed materials**

#### **68.3.1 Refined REE for magnets**

Coverage: World countries.

Time period of compiled data series: 2021.

Reference Year: 2021.

Data source(s): (Wood Mackenzie, 2022b).

Other collected/checked/registered datasets: -

Notes: Data aggregate the estimated refinery production of dysprosium, gadolinium, neodymium, praseodymium, samarium, and terbium (cerium is excluded). Recycling is included.

Latest RMIS Dashboard update: August 2023.

### **68.4 Additional information and insights about production**

- ✓ The share of REE for magnets in total REE mine production is based on JRC analysis;
- ✓ The breakdown of refined production by source is elaborated from (Wood Mackenzie, 2022b);
- ✓ The CAGR refers to primary (mining) production from 2012 to 2021.

### **68.5 Applications**

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data demonstrate the distribution of demand by end use.

Latest RMIS Dashboard update: August 2023.

### **68.6 Trade of primary materials**

Data are not available in the HS nomenclature (See section 67.6).

### **68.7 Trade of refined/processed materials**

Data are not available in the HS nomenclature (See section 67.7).

### **68.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No recent and adequate data are available to calculate or estimate the EOL-RIR in the EU. The EOL-RIR worldwide in 2021 is estimated to be 35% (as the share of EOL recycling in global supply) based on data from (Wood Mackenzie, 2022a); however, this figure is not considered applicable to the EU.

### **68.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are derived from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).



## 69 Rhenium

### 69.1 Resources and Reserves

#### 69.1.1 Resources

Data source(s): (Roskill, 2015a).

Reference Year: 2014

Notes: Estimate of rhenium resources contained in Cu-Mo porphyry deposits which have recorded rhenium to be present. The dataset does not include rhenium resources associated with Cu sedimentary deposits in Poland and Kazakhstan. The classification/code system of reporting is unspecified.

Latest RMIS Dashboard update: August 2021.

#### 69.1.2 Reserves

Data source(s): (USGS, 2023)(USGS, 2021).

Reference Year: 2021.

Notes: Reserves are defined according to the USGS classification system (USGS, 1980). Data for Peru and Canada were reported by (USGS, 2021).

Latest RMIS Dashboard update: August 2023.

### 69.2 Production of primary materials

No data are available for rhenium's mine production. Primary rhenium is predominantly extracted as a by-product from the extraction and processing of molybdenum ores associated with copper deposits.

### 69.3 Production of refined/processed materials

#### 69.3.1 Refined rhenium

Coverage: World countries.

Time period of compiled data series: 2004-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2008-2021, (Roskill, 2015a) for 2004-2007.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021) (USGS myb-Re, 2022) (2011-2021)

Notes: Recovered rhenium contained in molybdenite and copper concentrates. Secondary rhenium production is not included, e.g. from Germany, Estonia, USA and Canada. The dataset is complemented with data points for South Korea and Japan collected from (USGS myb-Re, 2022) & (Roskill, 2015a), and from Lipmann Walton & Co Ltd in (European Commission, 2020b) & (Roskill, 2015a), respectively.

Latest RMIS Dashboard update: August 2023.

### 69.4 Additional information and insights about production

- ✓ The refinery output by feed raw materials is estimated from information in (USGS myb-Re, 2021) related to the amount of rhenium recycled in 2017;
- ✓ The refinery capacity by countries is sourced from (Roskill, 2015a);
- ✓ The CAGR refers to refinery production (2012-2021).

## 69.5 Applications

Geographical scope: World.

Data source(s): (Roskill, 2015a).

Reference Year: 2014.

Notes: Data demonstrate the end uses of rhenium. The EU-specific distribution of demand is not available.

Latest RMIS Dashboard update: August 2021.

## 69.6 Trade of primary materials

No data can be extracted from international statistics for rhenium's primary materials. Rhenium is not produced from one particular ore, but is instead obtained as by-product of copper and molybdenum metallurgy. The HS nomenclature does not provide in the relevant headings the required disaggregation for rhenium-rich by-products from copper and molybdenum ore processing.

## 69.7 Trade of refined/processed materials

No data can be sourced from international trade statistics for rhenium's refined/processed materials. Unwrought rhenium and powders, perrhenic acid (PRA) and ammonium perrhenate (APR) are classified in the HS nomenclature in headings HS 811292, HS 281119, and HS 284190, respectively, which contain several metals and compounds of various raw materials.

## 69.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: World.

Data source(s): JRC calculation based on data from (Roskill, 2015a).

Reference Year: 2014.

Notes: The indicator is estimated as the ratio of secondary production to total production. Secondary production includes recycled Re metal and APR extracted from Re-containing EOL scrap and rhenium contained in engine revert, but excludes the recycling of spent catalyst and foundry revert (closed-loop recycling). It is supposed that the estimate of the indicator is appropriate for the EU as well.

Latest RMIS Dashboard update: August 2023.

## 69.9 Other Indicators

- ✓ The Import Reliance is sourced from (European Commission, 2023) and refers to the average 2016-2020. More information on the scope, data, and assumptions used are provided by (SCRREEN2, 2023).

## **70 Rhodium**

### **70.1 Resources and Reserves**

#### **70.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards

Latest RMIS Dashboard update: August 2023.

#### **70.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **70.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): : (WMD, 2023) for 2006-2021, (JM, 2019a) for 2000-2005.

Other collected/checked/registered datasets: (JM, 2019a) (2006-2013), (JM, 2019b) (2014-2016), (JM, 2022) (2017-2021), (Heraeus-SFA Oxford, 2022) (2018-2021), (USGS myb-PGM, 2023) (2014-2021).

Notes: Figures represent sales of primary PGM by producers and are allocated to where the initial mining took place rather than the location of subsequent refining.

Latest RMIS Dashboard update: August 2023.

### **70.3 Production of refined/processed materials**

#### **70.3.1 Refined rhodium**

Coverage: World total.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): Data for rhodium's primary production as above and data for secondary production from (JM, 2019a) for 2000-2013, (JM, 2019b) for 2014-2016, and (JM, 2022) for 2017-2021.

Other collected/checked/registered datasets: (Heraeus-SFA Oxford, 2022) (2018-2021).

Notes: Figures concern the total production of rhodium (primary & secondary). Country-specific data, covering also the production from secondary sources, are unavailable. The primary metallurgical production is almost equivalent to mining production (mine producers report metallurgically produced rhodium or rhodium payable, therefore recoverable). Secondary production (supply) is the quantity of metal recovered from open-loop recycling; closed-loop recycling is excluded.

Latest RMIS Dashboard update: August 2023.

## 70.4 Additional information and insights about production

- ✓ The refinery production by source is based on the associated data for primary and secondary production;
- ✓ The CAGR refers to refinery production (primary & secondary) between 2012 and 2021.

## 70.5 Applications

Geographical scope: World.

Data source(s): Data provided by (Johnson Matthey, 2022).

Reference Year: 2021.

Notes: The distribution of demand links to end-use applications/industrial segments. Figures for Europe or the EU are not available. It is evaluated that the global distribution is also applicable to the EU.

Latest RMIS Dashboard update: August 2023.

## 70.6 Trade of primary materials

The HS nomenclature does not provide the required detail for tracing the trade of PGM-bearing ores and concentrates in HS 261690; the code is entirely allocated to gold ores and concentrates in RMIS database.

## 70.7 Trade of refined/processed materials

Coverage: Trade data cover unwrought rhodium or rhodium in powder form (HS 711031). The trade of rhodium compounds (HS 284390) is not included as compounds of other metals are also classified within the heading. Trade of wrought products of rhodium and its alloys in semi-manufactured forms (made by forging, rolling or drawing) is excluded (HS 711039)

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 711031 *Metals; rhodium, unwrought or in powder form.*

Latest RMIS Dashboard update: August 2021.

## 70.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: World.

Data source(s): JRC calculation based on (Johnson Matthey, 2022).

Reference Year: 2021.

Notes: The EOL-RIR is derived as total recycling (from autocatalysts, electronics, and jewellery) divided by the total input of material consisting of primary supply, recycling and movement in stocks (gross demand). Closed-loop recycling is not included. It is assumed that the figure is also applicable in the EU.

Latest RMIS Dashboard update: November 2022.

## 70.9 Other Indicators

- ✓ The Import Reliance for extraction (primary materials) is assumed 100% as there is no mine production in the EU. The EU sourcing (EU supply) for the extraction stage (primary materials) is derived from (SCREEN2, 2023) and (European Commission, 2023). It represents the average global supply in 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **71 Ruthenium**

### **71.1 Resources and Reserves**

#### **71.1.1 Resources**

Data source(s): JRC elaboration based on background data from (Mudd *et al.*, 2018) and (Heraeus - SFA Oxford, 2020).

Reference Year: 2015.

Notes: -

Latest RMIS Dashboard update: August 2021.

#### **71.1.2 Reserves**

Data source(s): JRC elaboration based on background data from (Mudd *et al.*, 2018) and (Heraeus - SFA Oxford, 2020).

Reference Year: 2015.

Notes: -

Latest RMIS Dashboard update: August 2021.

### **71.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (USGS myb-PGM, 2023) for 2014-2021, JRC estimate for 2000-2013.

Other collected/checked/registered datasets: -

Notes: The assessment of production in 2000-2013 is based on production data from (BGS, 2023) for 'Other than Pt and Pd platinum-group metals', rhodium production reported by (WMD, 2023) and (JM, 2019a), osmium production provided by (Girolami, 2012), and Johnson Matthey's background data for ruthenium and iridium annual demand. To achieve the split between ruthenium and iridium primary production in 2000-2013, it is assumed that their yearly output was proportional to annual demand. Osmium production is considered steady each year. Production figures refer to where the initial mining took place rather than the location of subsequent refining.

Latest RMIS Dashboard update: August 2023.

### **71.3 Production of refined/processed materials**

Data are not available for secondary supply; therefore, the total annual supply (as a proxy of production) cannot be determined.

### **71.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production in 2012-2021.

### **71.5 Applications**

Geographical scope: World.

Data source(s): Data provided by (Johnson Matthey, 2022).

Reference Year: 2021.

Notes: The distribution of demand relates to end-use industrial segments. Figures for the European or the EU demand are not available. It is assumed that the global distribution is also applicable to the EU.

Latest RMIS Dashboard update: August 2023.

## 71.6 Trade of primary materials

The HS nomenclature does not provide the required detail for tracing the trade of PGM-bearing ores and concentrates in HS 261690; the code is entirely allocated to gold ores and concentrates in RMIS database.

## 71.7 Trade of refined/processed materials

Coverage: Trade data are associated with HS 711041 covering not only ruthenium and its alloys (unwrought and powders), but also iridium (and osmium). The trade of ruthenium compounds (HS 284390) is not included as compounds of other metals are also classified within the heading. Semi-manufactured forms of ruthenium are excluded.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes:

Relevant Harmonized System (HS) Codes: to HS 711041 *Metals; iridium, osmium, ruthenium, unwrought or in powder form*

Latest RMIS Dashboard update: August 2021.

## 71.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: World.

Data source(s): JRC estimate based on (UNEP, 2011).

Reference Year: NA

Notes: Sound data that allow the calculation of ruthenium's EOL-RIR are not available. A rough estimate for the EOL-RIR is 6% (ranging from 0% to 12%), derived in accordance with the guidance provided in the methodology for establishing the EU List of Critical Raw Materials (Blengini *et al.*, 2017) and data from (UNEP, 2011). The EOL-RIR is approximated by the median recycled content (RC) and the median old scrap ratio (OSR) of the ranges reported by (UNEP, 2011) (0-20% for the OSR and 50-60% for the RC). The estimate for the indicator is supposed to be suitable for the EU.

Latest RMIS Dashboard update: August 2021.

## 71.9 Other Indicators

- ✓ The Import Reliance for extraction (primary materials) is assumed 100% as there is no mine production in the EU. The EU sourcing (EU supply) for the extraction stage (primary materials) is derived from (SCREEN2, 2023) and (European Commission, 2023). It represents the average global supply in 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 72 Salt

### 72.1 Resources and Reserves

Data at country level are not available. Continental resources and reserves of rock salt are substantial whereas marine resources and reserves of salt are practically unlimited (USGS, 2023) (Kogel *et al.*, 2006).

### 72.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other data sources checked and/or compiled: (USGS myb-salt, 2023) (2000-2019), (BGS, 2023) (2006-2021).

Notes: Data include rock salt and evaporated salt (marine and brine). The output of Djibouti, Bonaire, Ecuador, Guinea, Mauritania, Mali, Netherland Antilles and Uzbekistan is compiled from BGS in 2006-2021.

Latest RMIS Dashboard update: August 2023.

### 72.3 Production of refined/processed materials

Not applicable. Refined salt products are considered as primary materials.

### 72.4 Additional information and insights about production

- ✓ The distribution of salt's output by extraction method is sourced from (EUsalt, 2023);
- ✓ The CAGR concerns primary (mining) production in 2012-2021.

### 72.5 Applications

Geographical scope: Europe.

Data source: (Ciech, 2023).

Reference Year: NA.

Notes: End-use market shares for rock salt and evaporated salt.

Latest RMIS Dashboard update: August 2023.

### 72.6 Trade of primary materials

Coverage: Data from heading HS 250100 are used for the estimation of global salt trade flows.

Data source: (WITS, 2023).

Reference Year: 2021.

Notes:

Relevant Harmonized System (HS) Codes: HS 250100 *Salt (including table salt and denatured salt); pure sodium chloride whether or not in aqueous solution; sea water.*

Latest RMIS Dashboard update: August 2023.

### **72.7 Trade of refined/processed materials**

Not applicable. Refined salt products are treated with primary materials under heading HS 250100.

### **72.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Minimal information exists to estimate the EOL-RIR in the EU.

### **72.9 Other Indicators**

- ✓ Information about the EU sourcing (EU supply) and the Import Reliance is not presented as the 2023 assessment of Critical raw materials for the EU did not cover salt.



## **73 Samarium**

### **73.1 Resources and Reserves**

Data are unavailable (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements).

### **73.2 Production of primary materials**

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and samarium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of samarium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### **73.3 Production of refined/processed materials**

The compiled information is not publicly available.

### **73.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **73.5 Applications**

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data reflect samarium's demand by end use.

Latest RMIS Dashboard update: August 2023.

### **73.6 Trade of primary materials**

There are no specific codes to samarium in international trade statistics (HS). Samarium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).

### **73.7 Trade of refined/processed materials**

There are no specific codes to samarium in international trade statistics (HS). Samarium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

### **73.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No data are available to calculate or estimate samarium's EOL-RIR in the EU.

### **73.9 Other Indicators**

- ✓ The EU sourcing (EU supply) is sourced from (SCREEN2, 2023) and relates to all forms of samarium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used is provided by (SCREEN2, 2023).

## **74 Sapele wood**

### **74.1 Resources and Reserves**

There is lack of information on the area harvested or covered by sapele trees (*Entandrophragma cylindricum*).

### **74.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2008-2021.

Reference Year: 2021.

Data source(s): JRC estimate based on (UN Comtrade, 2023)

Other collected/checked/registered datasets: -

Notes: Credible information on the global production of sapele wood is missing. Net exports (and exports derived indirectly from reported imports by destination countries) for sapele sawnwood (HS 440727) originating from countries in which the sapele tree is naturally distributed (West, Central and East Africa, from Ivory Coast to Uganda) are employed as a proxy of world's production of sapele roundwood. Trade data for sapele timber in the natural state (roundwood) are reported under HS 440349, but they cannot be used to approximate production as the trade code includes several species of tropical timber.

Latest RMIS Dashboard update: August 2023.

### **74.3 Production of refined/processed materials**

No data are available for the production of sapele sawnwood worldwide.

### **74.4 Additional information and insights about production**

- ✓ The CAGR refers to the estimated primary production (extraction) from 2012 to 2021.

### **74.5 Applications**

Geographical scope: NA.

Data source(s): Expert judgement in (European Commission, 2017b).

Reference Year: NA

Notes: Quantitative data for the end uses of sapele wood are missing.

Latest RMIS Dashboard update: August 2021.

### **74.6 Trade of primary materials**

Trade data for sapele roundwood are not available in international databases as the relevant code HS 440349 covers also other tropical timber.

### **74.7 Trade of refined/processed materials**

Coverage: Data refer to HS 440727 that addresses sapele sawnwood's trade.

Data source(s): (WITS, 2021)

Reference Year: 2019.

Notes: Exports originating from Angola, Cameroon, Democratic Republic of Congo, Central African Republic, Ghana and Gabon were estimated on the basis of reported imports by destination countries.

Relevant Harmonized System (HS) Codes: HS 440727 *Wood, tropical; sapelli, sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, thicker than 6mm.*

Latest RMIS Dashboard update: August 2021.

### **74.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No data are available for the calculation or estimation of the indicator. According to expert opinion in (European Commission, 2020a), the EOL-RIR of sapele wood is 0%.

### **74.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020.

## **75 Scandium**

### **75.1 Resources and Reserves**

#### **75.1.1 Resources**

Data source(s): JRC elaboration based on (Liu *et al.*, 2023)(Wang *et al.*, 2021)(Hoffmann *et al.*, 2019)(S&P, 2022).

Reference Year: not applicable.

Notes: -

Latest RMIS Dashboard update: August 2023.

#### **75.1.2 Reserves**

Available data are inadequate for a reliable coverage of global reserves.

### **75.2 Production of primary materials**

Existing information is insufficient to estimate scandium's primary production by countries.

### **75.3 Production of refined/processed materials**

#### **75.3.1 Refined scandium**

Coverage: World countries.

Time period of compiled data series: 2015-2021.

Reference Year: 2021.

Data source(s): JRC elaboration based on various sources such as (Lipmann, 2016)(BRGM, 2017a)(CM, 2018)(Grandfield, 2019)(MMTA, 2022)(USGS, 2021)(USGS, 2022)(USGS, 2023)(S&P, 2022).

Other collected/checked/registered datasets: -

Notes: Scandium production statistics are not available; the Chinese output is presumed to be stable over 2019-2021. The production of primary intermediate scandium compounds in Philippines is allocated to Japan where it is further refined.

Latest RMIS Dashboard update: August 2023.

### **75.4 Additional information and insights about production**

### **75.5 Applications**

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: Data indicate scandium's consumption by end uses.

Latest RMIS Dashboard update: August 2021.

## 75.6 Trade of primary materials

No data can be extracted from international trade statistics for scandium's primary raw materials. Scandium's trade flows are reported in HS headings grouped with other REE without granular detail (see the generic notes for REE's trade of primary materials section 67.6, applicable also for scandium).

## 75.7 Trade of refined/processed materials

Trade in scandium's refined/processed products tends to be opaque in international trade statistics. Unwrought scandium metal and interalloys/intermixtures of scandium are reported under heading HS 280530, and scandium compounds in HS 284690 clustered with several rare-earth metals and compounds of REE; HS 284690 may contain mixtures of rare-earth metals, yttrium and scandium that are considered a primary raw materials of rare earths (see also Section 67.6).

## 75.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: The indicator is calculated from background data provided by the source according to the methodology described in (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020).

Latest RMIS Dashboard update: August 2021.

## 75.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **76 Selenium**

### **76.1 Resources and Reserves**

#### **76.1.1 Resources**

Quantitative and comprehensive data on selenium resources are not available. Selenium occurs mostly in non-ferrous metal deposits (copper, nickel, etc.) and coal and it is obtained mainly as a by-product of copper.

#### **76.1.2 Reserves**

Data source(s): (USGS, 2023).

Reference Year: 2022.

Notes: Reserves are defined according to the USGS classification system (USGS, 1980). Figures are primarily based on the estimated selenium content of copper reserves.

Latest RMIS Dashboard update: August 2023.

### **76.2 Production of primary materials**

No data are available. Selenium is mostly recovered from anode slimes generated during the electrolytic refining of copper.

### **76.3 Production of refined/processed materials**

#### **76.3.1 Refined selenium**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2008-2021, (BGS, 2023) for 2000-2007.

Other collected/checked/registered datasets: (BGS, 2023) (2008-2021), (USGS myb-Se&Te, 2022) (2000-2020).

Notes: Data relate to refinery output (selenium compounds and elemental selenium).

Latest RMIS Dashboard update: August 2023.

### **76.4 Additional information and insights about production**

- ✓ The CAGR is derived from refinery production in 2012-2021.

### **76.5 Applications**

Geographical scope: World.

Data source(s): (Anderson, 2020), (STDA, 2023).

Reference Year: 2010

Notes: Figures are associated with the end uses of selenium. EU-specific data are not available.

Latest RMIS Dashboard update: August 2021.

## 76.6 Trade of primary materials

No data are available in the international trade statistics for selenium's primary materials. Selenium is recovered from the treatment of copper refinery slimes. Hence, the heading HS 262030 *Slag, ash and residues containing mainly copper* covering the trade of sludge from electrolytic baths after copper refining could be potentially used as a proxy. However, the code does not provide the necessary detail to distinguish copper slimes. Similarly, data on copper ores and concentrates trade are excluded (HS 260300) as the heading does not differentiate Se-bearing copper ores and concentrates.

## 76.7 Trade of refined/processed materials

Coverage: Data refer to HS 280490, which includes several forms of selenium (amorphous, vitreous, and crystallised). Specific trade data for various refined selenium compounds (e.g. selenium dioxide and salts of selenium acids) are not available due to the high aggregation with other compounds of the relevant HS headings in which they are classified (e.g. HS 281129, HS 284290).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Trade flows for Iran and Ukraine in 2019 are derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 280490 *Selenium*

Latest RMIS Dashboard update: August 2021.

## 76.8 End-of-Life Recycling Input Rate (EOL-RIR)

Data allowing a credible calculation or estimation of selenium's EOL-RIR are lacking. According to expert judgment in (European Commission, 2017b) and (European Commission, 2020b), and taking into account information from (UNEP, 2011), the indicator is estimated at 1%.

## 76.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).



## **77 Silica**

### **77.1 Resources and Reserves**

Country-specific data are not available. Industrial sand and quartz sand deposits are widespread.

### **77.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (Eurostat Prodc, 2023a)(USGS myb-Silica, 2022).

Other collected/checked/registered datasets: -

Notes: Data for silica production cover silica sand (industrial and quartz sand), quartz, quartzite, and other silica products. For EU countries, priority is given to the dataset provided by Prodc (PRC code 8121150). Data gaps in the Prodc dataset are covered by USGS data or are estimated through interpolation. The Chinese output from 2000 to 2016 (unreported) is estimated assuming an equal CAGR with 2017-2021 (output reported).

Latest RMIS Dashboard update: August 2023.

### **77.3 Production of refined/processed materials**

Not applicable

### **77.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production in 2012-2021.

### **77.5 Applications**

Geographical scope: EU28

Data source(s): (IMA Europe, 2018)(IMA Europe, 2019)

Reference Year: 2017.

Notes: Figures demonstrate the distribution of silica's demand by end use.

Latest RMIS Dashboard update: August 2021.

### **77.6 Trade of primary materials**

Coverage: Data capture the product aggregate of HS 250510 (Silica and quartz sand) and 250610 (naturally occurring quartz).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports originating from Sri Lanka were estimated on the basis of reported imports by destination countries. Also, trade flows in 2019 from/to Oman, Mozambique, Iran, Guyana, and Ukraine (imports-exports) is approximated by mirror trade flows.

Relevant Harmonized System (HS) Codes: HS 250510 *Sands; natural, silica and quartz sands, whether or not coloured; HS 250610 Quartz; other than natural sands.*

Latest RMIS Dashboard update: August 2021.

### **77.7 Trade of refined/processed materials**

Not applicable.

### **77.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Lack of data for the calculation or estimation of the EOL-RIR of silica.

### **77.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 78 Silicon metal

### 78.1 Resources and Reserves

No data are available for the mineral deposits of silica from which silicon metal could be produced.

### 78.2 Production of primary materials

No data are available for the output of the particular grades of silica (quartz) required for the production of silicon metal. Information on the production of all forms and qualities of silica are available in the raw material **Silica**.

### 78.3 Production of refined/processed materials

#### 78.3.1 Silicon metal

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (USGS myb-Si, 2022) (2009-2021), (USGS myb-ferroalloys, 2023) (2000-2008).

Notes: Data for South Africa in 2015-2021, and for Bosnia-Herzegovina, Iceland, Kazakhstan, Uzbekistan, and Laos in 2000-2021 are obtained from USGS. The US production from 2011 onwards is a JRC estimate based on an assumption of 40% Si metal in total reported US production of FeSi+Si metal, as derived from historical data in 2000-2010. Publicly-available data for the production of the highly refined form of silicon metal (electrical-grade) are not available.

Latest RMIS Dashboard update: August 2023.

#### 78.3.2 Ferrosilicon

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (USGS myb-Si, 2022) (2007-2021), (USGS myb-ferroalloys, 2023) (2000-2006).

Notes: Ferrosilicon has a distinct value chain from silicon metal e.g. different production method and applications; however, it is presented here as an important refined product of silicon (element). Data for China, Bosnia-Herzegovina, Hungary, Italy, Malaysia, Paraguay and Uruguay in 2000-2021 are sourced from USGS. The US production in 2011-2021 is a JRC estimate based on an assumption of 60% FeSi in total reported US production of FeSi+Si metal, as derived from historical data in 2000-2010.

Latest RMIS Dashboard update: August 2023.

### 78.4 Additional information and insights about production

- ✓ The CAGR is derived from silicon metal production between 2012 and 2021.

### 78.5 Applications

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015)

Reference Year: 2012

Notes: The figures show the end-use sectors of products containing silicon.

Latest RMIS Dashboard update: August 2021.

## 78.6 Trade of primary materials

Metallurgical quartz and quartzite from which silicon metal can be obtained are classified together with other grades of quartz and quartzite in HS headings 250610 and 250620, respectively. The metallurgical grades represent a small share of the total; therefore, available data in the HS nomenclature cannot reflect the trade of quartz and quartzite destined for the production of silicon metal.

## 78.7 Trade of refined/processed materials

Coverage: Data are derived from the aggregate of HS 280461 and HS 280469 comprising electrical grade silicon and metallurgical grade silicon, correspondingly. Silicon traded in ferro-alloy form (ferro-silicon) is not taken into account.

Data source(s): (WITS, 2021).

Reference Year: 2019

Notes: Mozambique's, Iran's, and Ukraine's trade for 2019 is derived from reported imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 280461 *Silicon; containing by weight not less than 99.99% of silicon*; HS 280469 *Silicon; containing by weight less than 99.99% of silicon*.

Latest RMIS Dashboard update: August 2021.

## 78.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: The indicator is calculated from background data reported by the source according to the methodology described in (Peiró *et al.*, 2018). Recycling of Al-Si alloys was not considered in the EC MSA study of 2015.

Latest RMIS Dashboard update: August 2021.

## 78.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **79 Silver**

### **79.1 Resources and Reserves**

#### **79.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **79.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **79.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (The Silver Institute & Metal Focus, 2022)(The Silver Institute & Metal Focus, 2021) (2011-2021), (USGS myb-Ag, 2022) (2015-2020)

Notes: Mined silver production

Latest RMIS Dashboard update: August 2023.

### **79.3 Production of refined/processed materials**

#### **79.3.1 Refined silver**

Coverage: World total.

Time period of compiled data series: 2000-2022.

Reference Year: 2022.

Data source(s): (The Silver Institute & Metal Focus, 2023) for 2014-2022, (The Silver Institute & Metal Focus, 2022) for 2013, (The Silver Institute & Metal Focus, 2021) for 2012, (The Silver Institute & Metal Focus, 2020) for 2011, (The Silver Institute and Refinitiv, 2019) for 2009-2010, (The Silver Institute & Thomson Reuters, 2018) for 2008, (The Silver Institute & Thomson Reuters, 2017) for 2007, (The Silver Institute, 2016) for 2000-2006.

Other collected/checked/registered datasets: -

Notes: The total silver supply (primary & secondary) is used as a proxy for silver's refined production, i.e. production of silver bullion or grain.

Latest RMIS Dashboard update: August 2021.

## 79.4 Additional information and insights about production

- ✓ Information on the distribution of silver's mine production by host metal is provided by (The Silver Institute & Metal Focus, 2023);
- ✓ The production of refined silver by feedstock is sourced from (The Silver Institute & Metal Focus, 2023);
- ✓ The CAGR refers to refinery production (2013-2022), including primary and secondary silver.

## 79.5 Applications

Geographical scope: World.

Data source(s): Data published by (The Silver Institute & Metal Focus, 2022).

Reference Year: 2021.

Notes: End-use demand of silver. Physical Investment is split into 'Coins & medals' and 'Bars'. EU-related data are unavailable for the reference year.

Latest RMIS Dashboard update: August 2023.

## 79.6 Trade of primary materials

Coverage: The trade of primary silver ores and concentrates is reported under HS 261610 (e.g. argentite). Primary silver represented about 29% of the total silver supply in 2019 (The Silver Institute and Refinitiv, 2019). It is not possible to account for the trade of silver contained as co- or by-product in ores and concentrates of other metals (e.g. Cu, Pb), and silver-bearing residues (e.g. slag, dross, slime) from the metallurgical processing of ores and concentrates hosting silver.

Data source(s): (WITS, 2021).

Reference Year: 2019

Notes: Exports originating from Argentina, Bolivia, Chile, and Russia are derived from declared imports by destination countries (as well as for India, Serbia, Tajikistan, Indonesia among minor producers).

Relevant Harmonized System (HS) Codes: HS 261610 *Silver ores and concentrates*.

Latest RMIS Dashboard update: August 2021.

## 79.7 Trade of refined/processed materials

Coverage: The trade of refined/processed silver materials is represented of the aggregate of HS 284321, HS 284329, HS 710610 and HS 710691 covering silver nitrate and other silver compounds (e.g. silver halides and oxides), silver powder, and unwrought silver and its alloys. Trade of colloidal silver (HS 284310) and silver amalgams (HS 284390) is not included due to the low granularity of the HS headings. Wrought products of silver and silver alloys are excluded (HS 710692).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports of Bolivia (as well as of some minor producers) are derived from reported imports by destination countries. Mozambique's, Iran's, and Ukraine's trade flows for 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 284321 *Silver compounds; silver nitrates*; HS 284329 *Silver compounds; excluding silver nitrates*; HS 710610 *Metals; silver powder*; HS 710691 *Metals; silver, unwrought, (but not powder)*.

Latest RMIS Dashboard update: August 2021.

## 79.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU

Data source(s): JRC calculation based on background data from (The Silver Institute & Metal Focus, 2022)

Reference Year: 2021

Notes: The EOL-RIR is derived as the share of recycling in total demand. Data for silver fabrication reported by (The Silver Institute and Refinitiv, 2019) are used to estimate the share of EU in European demand reported by (The Silver Institute & Metal Focus, 2022). Recycling covers the recovery of silver from fabricated products, including unused trade stocks and excludes scrap generated during manufacturing (new scrap). Recycling is captured in the country where the scrap is generated, which may differ from where it is refined.

Latest RMIS Dashboard update: August 2023.

## **79.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020; the share of Poland in EU sourcing is a JRC estimate. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **80 Strontium**

### **80.1 Resources and Reserves**

Information on the global distribution of resources and reserves of strontium minerals is scarce.

### **80.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023)

Other collected/checked/registered datasets: (USGS myb-Sr, 2022) (2000-2021).

Notes: Production data relate to concentrates of strontium minerals (celestite) .

Latest RMIS Dashboard update: August 2023.

### **80.3 Production of refined/processed materials**

Absence of publicly available information on the production of refined materials (e.g. strontium compounds such as strontium carbonate and nitrate).

### **80.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production in 2012-2021.

### **80.5 Applications**

Geographical scope: United States.

Data source(s): (USGS, 2021).

Reference Year: 2020.

Notes: Estimated end-use demand distribution in the United States. It is considered representative for the EU after excluding the use of celestite for oil and gas drilling fluids and redistributing the shares of other applications.

Latest RMIS Dashboard update: August 2021.

### **80.6 Trade of primary materials**

Specific data in the HS nomenclature are not available as the trade of strontium primary raw materials (celestite and strontianite) is classified in the highly aggregated heading HS 253090 that comprises many mineral commodities.

### **80.7 Trade of refined/processed materials**

Coverage: Trade data cover precipitated strontium carbonate (HS 283692). Strontium metal (HS 280519) and strontium salts and compounds such as nitrates of strontium, strontium sulphide and strontium oxides, hydroxides and peroxides, are not considered as the respective HS headings contain substances of several other materials.

Data source(s): (WITS, 2021).

Reference Year: 2019



Notes: Iran's, Mozambique's and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 283692 *Carbonates; strontium carbonate*.

Latest RMIS Dashboard update: August 2021.

### **80.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: World.

Data source(s): JRC assessment based on (UNEP, 2011) (USGS mcs, 2023).

Reference Year: 2022.

Notes: Existing data for the calculation/estimation of the EOL-RIR in the EU or globally are insufficient. Strontium's EOL-RIR is inferred from (UNEP, 2011) and (USGS mcs, 2023).

### **80.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 81 Sulphur

### 81.1 Resources and Reserves

Country-specific information on resources and reserves of elemental sulphur and sulphur associated with fossil fuels (petroleum, natural gas), sulphide ores, gypsum and anhydrite etc, is insufficient. In addition, because petroleum and sulphide ores can be processed long distances from where they are extracted, sulphur production may not be in the country to which the reserves were attributed. In general, reserves of sulphur in crude oil, natural gas, and sulphide ores are large, whereas the sulphur in gypsum and anhydrite is almost infinite (USGS, 2023).

### 81.2 Production of primary materials

The production of native (elemental) sulphur and pyrites is allocated to refinery production.

### 81.3 Production of refined/processed materials

#### 81.3.1 Sulphur (in all forms)

Coverage: World countries.

Time period of compiled data series: 2006-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023).

Other collected/checked/registered datasets: (USGS myb-S, 2023) (2000-2021).

Notes: It is deduced from background information in the collected sources, that data may reflect the production of Frasch sulphur, other native sulphur, pyrites-derived sulphur, by-product sulphur recovered as elemental sulphur or as sulphur compounds from metallurgical operations, petroleum refineries, from extraction of crude oil and natural gas, mined gypsum-derived sulphur and sulphur recovered from oil sands. The production of Belgium, Netherlands and Uzbekistan is sourced from (USGS myb-S, 2023).

Latest RMIS Dashboard update: August 2023.

### 81.4 Additional information and insights about production

- ✓ The sulphur output by industrial segment and by raw material is sourced from (USGS myb-S, 2023);
- ✓ The CAGR relates to the production all forms of refined sulphur in 2012-2021.

### 81.5 Applications

Geographical scope: United States.

Data source(s): JRC elaboration based on (Apodaca, 2022).

Reference Year: 2018.

Notes: Figures reflect the end-use sectors of products containing sulphur and are assumed to be applicable to the EU.

Latest RMIS Dashboard update: August 2021.

### 81.6 Trade of primary materials

Coverage: Aggregate of HS 250200 and HS 250300 taking into account unroasted iron pyrite, and crude mineral sulphur/unrefined sulphur, respectively. It is noted that the heading HS 250300 reports also trade of sulphur in refined forms.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports originating from United Arab Emirates (top exporter), Bahrain, Libya, Turkmenistan and Venezuela are derived from declared imports from destination countries. Oman's, Mozambique's, Iran's, Guyana's, and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 250200 *Iron pyrites; unroasted*; HS 250300 *Sulphur of all kinds; other than sublimed, precipitated and colloidal sulphur*.

Latest RMIS Dashboard update: August 2021.

### **81.7 Trade of refined/processed materials**

Coverage: Aggregate of HS 280200 (sublimed sulphur, precipitated sulphur and colloidal sulphur) and HS 280700 (sulphuric acid and oleum). Several forms of processed sulphur are not encompassed i.e. refined sulphur, micronised sulphur powders and sulphur  $\mu$ , as they are reported within HS heading 250300 together with crude/unrefined sulphur. Sulphur dioxide and sulphur trioxide are also left out of the aggregate due to the low detail of the HS headings in which these products are classified (HS 281129).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Data for Iran's, Mozambique's, Ukraine's and Myanmar's trade flows are derived from declared imports and exports by reporting partners. DRC's trade data are collected from (UN Comtrade, 2022).

Relevant Harmonized System (HS) Codes:

HS 280200 *Sulphur; sublimed or precipitated, colloidal sulphur*; HS 280700 *Sulphuric acid; oleum*.

Latest RMIS Dashboard update: August 2021.

### **81.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No data are available on the recycling of spent or contaminated sulphuric acid in order to estimate or calculate the EOL-RIR of sulphur in the EU or globally.

### **81.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 82 Talc

### 82.1 Resources and Reserves

Quantitative estimates of the distribution of talc resources are lacking. World reserves are ample; available information on their distribution by country is partial.

### 82.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (WMD, 2023) for 2006-2021, (USGS myb-talc, 2022) (2014-2021).

Notes: Figures specify the production of talc, pyrophyllite and other similar minerals (e.g. steatite). The output of Afghanistan in 2016-2021 is sourced from (USGS myb-talc, 2022).

Latest RMIS Dashboard update: August 2023.

### 82.3 Production of refined/processed materials

Not applicable.

### 82.4 Additional information and insights about production

- ✓ The split of production per mineral is sourced from (USGS myb-talc, 2022);
- ✓ The CAGR refers to primary (mining) production in 2012-2021.

### 82.5 Applications

Geographical scope: EU28.

Data source(s): (IMA Europe, 2018)(IMA Europe, 2019).

Reference Year: 2017.

Notes: Figures shown indicate the end uses of talc.

Latest RMIS Dashboard update: August 2021.

### 82.6 Trade of primary materials

Coverage: Aggregate data are used from headings HS 252610 and HS 252620 covering natural steatite and talc.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Mozambique's, Iran's, Guyana's, and Ukraine's trade flows for 2019 is deduced from reported imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 252610 *Natural steatite, whether or not roughly trimmed or merely cut, by sawing or otherwise, into blocks or slabs of a square or rectangular shape, and talc, uncrushed or unpowdered*; HS 252620 *Natural steatite and talc, crushed or powdered*.

Latest RMIS Dashboard update: August 2021.

### **82.7 Trade of refined/processed materials**

Not applicable.

### **82.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Available data are insufficient for the calculation of the EOL-RIR.

### **82.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **83 Tantalum**

### **83.1 Resources and Reserves**

#### **83.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **83.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **83.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (USGS myb-Ta, 2022).

Other collected/checked/registered datasets: (WMD, 2023) (2006-2021), (BGS, 2023) (2000-2021), (TIC, 2020) (2009-2018).

Notes: Data relate to marketable tantalum mineral concentrates; it is assessed that tantalum-bearing tin slags are not included. The production of Spain, Malaysia and Sierra Leone is sourced from (WMD, 2023). The French production is assumed steady over 2000-2021 based on information from (BRGM, 2012) and (BRGM, 2020b). Zimbabwe's output in 2017-2021 is collected from (BGS, 2023).

Latest RMIS Dashboard update: August 2023.

### **83.3 Production of refined/processed materials**

#### **83.3.1 Processed tantalum products**

Coverage: World total.

Time period of compiled data series: 2002-2018

Reference Year: 2018.

Data source(s): (TIC, 2020) for 2009-2018, (TIC, 2013) for 2002-2008.

Other collected/checked/registered datasets: -

Notes: Data relate to tantalum product shipments by processors.

Latest RMIS Dashboard update: August 2021.

#### **83.4 Additional information and insights about production**

- ✓ The production of primary tantalum by source is obtained from (Roskill, 2016);

- ✓ The distribution by country of smelters, refiners, and processors is collected from (RMI, 2023). The list comprises conformant installations with the Responsible Minerals Initiative's (RMI) standards and eligible installations to undergo an RMI assessment;
- ✓ The shipments of processed tantalum products in 2018 are sourced from (TIC, 2020);
- ✓ The CAGR related to primary production of tantalum between 2012 and 2021.

### **83.5 Applications**

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: The distribution of applications concerns products used in the EU (end uses).

Latest RMIS Dashboard update: August 2021.

### **83.6 Trade of primary materials**

The HS nomenclature does not provide the required detail to determine the trade of tantalum's primary materials. Tantalite concentrates and Nb-Ta concentrates are reported under HS 261590 that involves concentrates of other materials. Similarly, the trade of tantalum-rich slags and residues from metallurgical processing is captured in the highly aggregated heading HS 262099.

### **83.7 Trade of refined/processed materials**

Coverage: Data correspond to HS 810320 comprising unwrought and tantalum, powders and its alloys. It is not possible to include in the trade of tantalum's refined/processed products data for fluorotantalates (K<sub>2</sub>TaF<sub>7</sub>) obtained from tantalum metallurgy, tantalum oxide, and other tantalum compounds (chlorides and carbides) as they are reported in HS headings together with other commodities. Tantalum in wrought forms and shaped tantalum articles are excluded (HS 810390).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: -

Relevant Harmonized System (HS) Codes: HS 810320 *Tantalum; unwrought, including bars and rods obtained simply by sintering, powders.*

Latest RMIS Dashboard update: August 2021.

### **83.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: Taking into account the methodology provided by (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020), the indicator is calculated from background data provided by the source.

Latest RMIS Dashboard update: August 2021.

### **83.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).



## 84 Teak wood

### 84.1 Resources and Reserves

#### 84.1.1 Resources

Data source(s): JRC elaboration based on (Midgley *et al.*, 2015), (Kollert and Cherubini, 2012), (KU-ITTO-TeakNet, 2022)

Reference Year: 2010 for planted teak, various for natural teak

Notes: Data refer to both natural and planted teak (*Tectona grandis*). The estimated area of natural teak forests (productive and under protection) and the area of teak plantations is assumed to demonstrate teak resources.

Latest RMIS Dashboard update: August 2023.

#### 84.1.2 Reserves

Data source(s): JRC estimate based on (Kollert and Cherubini, 2012), (KU-ITTO-TeakNet, 2022)

Reference Year: 2021 for Thailand, Indonesia and Lao People's Democratic Republic, 2010 for Myanmar, 1992 for India

Notes: Data correspond to natural teak. Estimates of the area covered by productive teak forests is considered a proxy to natural teak reserves. Indonesia is regarded as part of teak's natural distribution as teak has been planted and cultivated for hundreds of years and has since 'naturalised' (Midgley *et al.*, 2015).

Latest RMIS Dashboard update: August 2023.

### 84.2 Production of primary materials

Coverage: World countries (partial).

Time period of compiled data series: 2010.

Reference Year: 2010.

Data source(s): (Kollert and Cherubini, 2012).

Other collected/checked/registered datasets: -

Notes: Minimal data exist on the total commercial teak volume harvested globally from natural and planted teak forests. Several teak-producing countries are not covered by the dataset, e.g., India, a major source of native teak. The estimated total production of natural teak and plantation teak is derived if all teak-growing countries are considered.

Latest RMIS Dashboard update: August 2023.

### 84.3 Production of refined/processed materials

No data are available for the production of teak sawnwood.

### 84.4 Additional information and insights about production

- ✓ The teak harvest by forest type is sourced from (Kollert and Cherubini, 2012).

### 84.5 Applications

Geographical scope: EU.

Data source(s): Expert judgement in (European Commission, 2017b).

Reference Year: NA.

Notes: Quantitative information on applications of teak wood is sparse.

Latest RMIS Dashboard update: August 2021.

### **84.6 Trade of primary materials**

Trade of teak wood is reported under HS 440349; however, the code covers several species of tropical timber, and, therefore, the individual trade flows of teak roundwood cannot be ascertained.

### **84.7 Trade of refined/processed materials**

Trade of teak wood is reported under HS 440729; though, the code includes several species of tropical timber, and the specific trade flows of teak sawnwood cannot be determined.

### **84.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No data are available for the calculation or estimation of the indicator. According to expert opinion in (European Commission, 2020a), the EOL-RIR of natural teak wood is 0%.

### **84.9 Other Indicators**

- ✓ The Import Reliance for extraction (primary materials) is sourced from (European Commission, 2023) and refers to the average 2016–2020.

## 85 Tellurium

### 85.1 Resources and Reserves

#### 85.1.1 Resources

Quantitative and comprehensive data on tellurium resources are not available. Selenium occurs mostly in non-ferrous metal deposits (copper, nickel, etc.) and coal and it is obtained mainly as a by-product of copper.

#### 85.1.2 Reserves

Data source(s): (USGS, 2023).

Reference Year: 2022.

Notes: Reserves are defined according to the USGS classification system (USGS, 1980). Figures are based on identified copper deposits and average tellurium content.

Latest RMIS Dashboard update: August 2023.

### 85.2 Production of primary materials

As tellurium is mainly a by-product of copper mining, no data are available for mine production, i.e. tellurium contained in copper ores and concentrates.

### 85.3 Production of refined/processed materials

#### 85.3.1 Refined tellurium

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC elaboration based on (USGS myb-Se&Te, 2022) for 2000-2020, and (USGS, 2023) for 2021.

Other collected/checked/registered datasets: (WMD, 2023) (2006-2021), (BGS, 2023) (2000-2021), (Eurostat Prodcom, 2023b) (2019-2021).

Notes: Data relate to the countries where tellurium is recovered and refined. Obtaining comprehensive and robust data for the annual output of tellurium is challenging due to its by-product nature and the unreported production in major producing countries. The US and Chinese production are sourced from (BGS, 2023). The production of Germany and Belgium is a JRC estimate based on (Nassar *et al.*, 2022) and the production of Finland is approximated from (Eurostat Prodcom, 2023b). The output of Uzbekistan is obtained from (WMD, 2023).

Latest RMIS Dashboard update: August 2023.

### 85.4 Additional information and insights about production

- ✓ The CAGR relates to refinery production between 2012 and 2021.

### 85.5 Applications

Geographical scope: World.

Data source(s): (Anderson, 2020), (STDA, 2023).

Reference Year: 2010.

Notes: Figures illustrate the end uses of tellurium. EU-related data are not available.

Latest RMIS Dashboard update: August 2021.

## 85.6 Trade of primary materials

There are no specific codes in international trade statistics (HS) to tellurium's primary raw materials. As the majority of tellurium produced worldwide is a by-product of electrolytic copper refining, the heading HS 262030 *Slag, ash and residues containing mainly copper* covers the trade of sludges from electrolytic baths generated during metals refining. However, the heading's detail for contained tellurium is not adequate. Trade of copper ores and concentrates (HS 260300) and ores and concentrates of other metals that may contain tellurium is also excluded.

## 85.7 Trade of refined/processed materials

Specific trade data for several tellurium compounds (e.g. salts of tellurium acids under HS 284290) are not available due to the high aggregation of HS headings in which they are classified. HS 280450 contains both tellurium and boron and requires splitting in order to be representative for tellurium.

## 85.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: World.

Data source(s): Expert judgment in (European Commission, 2017b)(European Commission, 2020b) .

Reference Year: NA.

Notes:

Latest RMIS Dashboard update: August 2021.

## 85.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 86 Terbium

### 86.1 Resources and Reserves

Data are unavailable (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements).

### 86.2 Production of primary materials

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and terbium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of terbium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### 86.3 Production of refined/processed materials

The compiled information is not publicly available.

### 86.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 86.5 Applications

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data show the distribution of demand by end use.

Latest RMIS Dashboard update: August 2023.

### 86.6 Trade of primary materials

There are no specific codes to terbium in international trade statistics (HS). Terbium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section section 67.6).

### 86.7 Trade of refined/processed materials

There are no specific codes to terbium in international trade. Terbium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section section 67.7).

## **86.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2013.

Notes: The indicator is calculated from background data provided by the source according to the methodology described in (Peiró *et al.*, 2018).

Latest RMIS Dashboard update: August 2023.

## **86.9 Other Indicators**

- ✓ The EU sourcing (EU supply) originates from (SCRREEN2, 2023) and relates to all forms of terbium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## 87 Thulium

### 87.1 Resources and Reserves

No data have been collected (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### 87.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and thulium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of thulium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### 87.3 Production of refined/processed materials

The collected information is not publicly available.

### 87.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 87.5 Applications

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a)

Reference Year: 2021.

Notes: Data relate to thulium's demand by end use.

Latest RMIS Dashboard update: August 2023.

### 87.6 Trade of primary materials

There are no specific codes for thulium in international trade statistics (HS). Its trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section section 67.6).

### **87.7 Trade of refined/processed materials**

There are no specific codes to thulium in international trade statistics (HS). Their trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

### **87.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Data to calculate or estimate the EOL-RIR in the EU are missing.

### **87.9 Other Indicators**

- ✓ The EU sourcing (EU supply) is sourced from (SCRREEN2, 2023) and relates to all forms of thulium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used are provided by (SCRREEN2, 2023).



## **88 Tin**

### **88.1 Resources and Reserves**

#### **88.1.1 Resources**

Data source(s): (ITA, 2020).

Reference Year: 2020.

Notes: The estimate of mineral resources includes compliant and non-compliant data to CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **88.1.2 Reserves**

Data source(s): (ITA, 2020).

Reference Year: 2020.

Notes: The estimate of mineral reserves includes compliant and non-compliant data to CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **88.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other collected/checked/registered datasets: (BGS, 2023) (2006-2021), (USGS myb-Sn, 2022) (2000-2020)

Notes: Mine production of tin.

Latest RMIS Dashboard update: August 2023.

### **88.3 Production of refined/processed materials**

#### **88.3.1 Refined tin**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023) .

Other collected/checked/registered datasets: (USGS myb-Sn, 2022) (2000-2020).

Notes: Figures relate to tin smelter production and comprise both primary (from ores and concentrates) and secondary metal (tin metal recovered from old scrap). Small quantities produced in Bulgaria, Czechia, Denmark, Greece, Norway and Spain are sourced from (USGS myb-Sn, 2022).

Latest RMIS Dashboard update: August 2023.

### **88.4 Additional information and insights about production**

- ✓ The CAGR is calculated on the basis of refined tin production in 2012-2021.

## 88.5 Applications

Geographical scope: World.

Data source(s): (ITinA, 2021).

Reference Year: 2020.

Notes: Based on International Tin Association's estimates of refined tin use worldwide. Data are not considered applicable to the EU.

Latest RMIS Dashboard update: August 2023.

## 88.6 Trade of primary materials

Coverage: The heading HS 260900 is employed for international trade (cassiterite and stannite). The trade of metallurgical by-products rich in tin such as tin dross, used either for the extraction of tin or as a basis for the manufacture of its chemical compounds are not included as the relevant HS heading (HS 262099) aggregates various metallurgical residues containing several metals.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports of Myanmar, Bolivia and DRC in 2019 are estimated from reported imports from country destinations in (UN Comtrade, 2022).

Relevant Harmonized System (HS) Codes: HS 260900 *Tin ores and concentrates*.

Latest RMIS Dashboard update: August 2021.

## 88.7 Trade of refined/processed materials

Coverage: Data are derived from the aggregate of HS 800110 and HS 800120 including unwrought non-alloyed tin and unwrought tin alloys. Bronze and other alloys in which tin is not the principal element are excluded (e.g. HS 740322). Specific data for various tin compounds (e.g. tin oxides and hydroxides, tin chloride, potassium stannate, tin sulphide) are not available in the HS nomenclature due to the high aggregation with other compounds within the relevant headings (e.g. in HS 282590; HS 282739; HS 283090; HS 284190). Semi-finished tin products are not accounted in the aggregate (HS 800300, HS 800700).

Data source(s): (WITS, 2021)

Reference Year: 2019

Notes: Iran's and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners. Bolivia's exports are derived from declared imports from destination countries in (UN Comtrade, 2022).

Relevant Harmonized System (HS) Codes: HS 800110 *Unwrought tin, not alloyed*; HS 800120 *Unwrought tin alloys*.

Latest RMIS Dashboard update: August 2021.

## 88.8 End-of-Life Recycling Input Rate (EOL-RIR)

Insufficient data are available to make reasonable estimates of tin's EOL-RIR. A rough estimate for the EOL-RIR globally is 11%, concluded according with the guidance provided in the methodology for establishing the EU List of Critical Raw Materials (Blengini *et al.*, 2017) and data from (UNEP, 2011). The International Tin Association reported that the RIR (recycled content), i.e. the contribution of recycled tin to total tin use (including tin recovered from manufacturing waste and residues), was 33% in 2020 (ITinA, 2023).

## 88.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for the processing stage (refined materials) are sourced from (European Commission, 2023) and refer to the average 2008-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## 89 Titanium

### 89.1 Resources and Reserves

#### 89.1.1 Resources

Data source(s): (Zinke and Werkheiser, 2017).

Reference Year: NA

Notes: The reported data are associated with Ilmenite (including titanomagnetite and leucoxene) and rutile (including anatase and brookite).

Latest RMIS Dashboard update: August 2021.

#### 89.1.2 Reserves

Data source(s): (USGS, 2023).

Reference Year: 2022.

Notes: Reserves are defined according to the USGS classification system (USGS, 1980).

Latest RMIS Dashboard update: August 2023.

Data source(s): (USGS, 2023).

### 89.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023) (in gross weight of Ti minerals).

Other collected/checked/registered datasets: (WMD, 2023) (2006-2021, in TiO<sub>2</sub> content), (USGS myb-Ti, 2023).

Notes: -

Latest RMIS Dashboard update: August 2023.

### 89.3 Production of refined/processed materials

Production data for titanium dioxide (TiO<sub>2</sub>) pigments are not available.

### 89.4 Additional information and insights about production

- ✓ The allocation of mine production by mineral is sourced from (USGS myb-Ti, 2023);
- ✓ The consumption of titanium minerals by downstream industry is sourced from (Murphy and Frick, 2006);
- ✓ Information on the capacity of titanium pigments is collected from (USGS, 2023);
- ✓ The CAGR is calculated from primary (mining) production from 2012 to 2021.

### 89.5 Applications

Geographical scope: World.

Data source(s): (BRGM, 2017b), data from Société Chimique de France.

Reference Year: 2013.

Notes: Figures indicate the end uses of titanium oxide (TiO<sub>2</sub>). It is assessed that the distribution is also applicable in the EU.

Latest RMIS Dashboard update: August 2023.

### **89.6 Trade of primary materials**

Coverage: The HS heading considered for titanium's primary raw materials is HS 261400 covering ilmenite and rutile.

Data source(s): (WITS, 2023).

Reference Year: 2021.

Notes: Exports of Sierra Leone, and Norway are sourced from reported imports by trade partners.

Relevant Harmonized System (HS) Codes: HS 261400 *Titanium ores and concentrates*.

Latest RMIS Dashboard update: August 2023.

### **89.7 Trade of refined/processed materials**

Coverage: The trade of refined/processed titanium is represented by HS 282300 covering titanium dioxide (unfinished pigments). Preparations of titanium oxide for use as pigments (finished pigments) are excluded (HS 320611 and HS 320619). Finally, various titanium chemicals (e.g. sulphates) are not included due to the insufficient level of detail of the relevant HS headings.

Data source(s): (WITS, 2023).

Reference Year: 2021.

Notes:

Relevant Harmonized System (HS) Codes: HS 282300 *Titanium oxides*.

Latest RMIS Dashboard update: August 2021.

### **89.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Available information for the estimation of the EOL-RIR of titanium oxide in the EU or globally is inadequate.

### **89.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **90 Titanium metal**

### **90.1 Resources and Reserves**

See section 89.1 on the distribution of titanium mineral resources and reserves.

### **90.2 Production of primary materials**

The production of primary raw materials associated with the extraction of titanium metal is presented in the Raw Material *Titanium*.

### **90.3 Production of refined/processed materials**

#### **90.3.1 Titanium sponge**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC elaboration on the basis of several sources i.e. (USGS mcs, 2023)(ITA, 2021)(Gehler, 2013)(Gehler, 2020)(CNIA, 2021).

Other collected/checked/registered datasets: -

Notes: Data refer to the production of titanium sponge.

Latest RMIS Dashboard update: August 2023.

#### **90.3.2 Titanium metal products**

Coverage: EU countries (partial).

Time period of compiled data series: 2009-2020.

Reference Year: 2020.

Data source(s): JRC elaboration based on (Eurostat Prodcom, 2023a).

Other collected/checked/registered datasets: -

Notes: Data reflect the sold production of titanium products (unwrought, powders, wrought) (PRC code: 24453043 *Titanium and articles thereof (excluding waste and scrap), n.e.c.* The output of countries for which figures are withheld in the data source is included in the group "Other EU".

Latest RMIS Dashboard update: August 2023.

#### **90.3.3 Ferrotitanium**

Coverage: World countries.

Time period of compiled data series: 2010-2020.

Reference Year: 2020.

Data source(s): (USGS myb-ferroalloys, 2023).

Other collected/checked/registered datasets: (BGS, 2023) (2000-2021).

Notes: China's production from 2012 to 2020 is assumed equal to the annual average of 2006-2011.

Latest RMIS Dashboard update: August 2023.

## 90.4 Additional information and insights about production

- ✓ The production capacity of titanium ingots is elaborated from (Louvigné, 2021);
- ✓ The CAGR refers to titanium sponge production from 2012 to 2021.

## 90.5 Applications

Geographical scope: Europe.

Data source(s): (Louvigné, 2021).

Reference Year: 2019.

Notes: Data designate the end uses of titanium metal.

Latest RMIS Dashboard update: July 2022.

## 90.6 Trade of primary materials

See Section 89.6 regarding titanium minerals.

## 90.7 Trade of refined/processed materials

Coverage: The trade of refined/processed titanium is represented by the product aggregate of HS 720291 and HS 810820, covering titanium in ferro-alloy form (ferro-titanium & ferro-silico-titanium), and unwrought titanium metal (sponge, powder, ingots and other forms), respectively. Wrought forms (mill products and articles) of titanium are excluded (HS 810890).

Data source(s): (WITS, 2023).

Reference Year: 2021.

Notes: -

Relevant Harmonized System (HS) Codes: HS 720291 *Ferro-alloys; ferro-titanium and ferro-silico-titanium*; HS 810820 *Titanium; unwrought, powders*.

Latest RMIS Dashboard update: August 2023.

## 90.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: World.

Data source(s): JRC estimate based on (UNEP, 2011).

Reference Year: NA.

Notes: Recent and reliable data that allow the calculation of titanium metal's EOL-RIR in the EU are unavailable. The approximate value for the EOL-RIR is derived according with the guidance provided in the methodology for establishing the EU List of Critical Raw Materials (Blengini *et al.*, 2017) and data from (UNEP, 2011). It is assumed that the figure is also applicable in the EU. Another rough estimate for the EOL-RIR globally is 3%, derived from data shown by (Roberts, 2018) and considering the recycling of titanium metal and ferrotitanium.

Latest RMIS Dashboard update: August 2021.

## 90.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for processing (refined materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **91 Tungsten**

### **91.1 Resources and Reserves**

#### **91.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards

Latest RMIS Dashboard update: August 2023.

#### **91.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **91.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (WMD, 2023) (2006-2021), (USGS myb-W, 2021) (2000-2019).

Notes: Production of tungsten concentrates.

Latest RMIS Dashboard update: August 2023.

### **91.3 Production of refined/processed materials**

#### **91.3.1 Products of refined tungsten**

Coverage: EU countries.

Time period of compiled data series: 2011-2021.

Reference Year: 2021.

Data source(s): JRC elaboration based on (Eurostat Prodcum, 2023a) (Eurostat Prodcum, 2023b).

Other collected/checked/registered datasets: -

Notes: The dataset comprises the production of tungsten products (unwrought, powders & wrought). PRC code: 24453013 *Tungsten (wolfram) and articles thereof (excluding waste and scrap), n.e.c.* Data concern total production (except Germany for which data available data refer to sold production). Data for France in 2019, and figures for 'Other EU' (including Sweden, Poland, Czechia) are a JRC estimate.

Latest RMIS Dashboard update: August 2023.



## 91.4 Additional information and insights about production

- ✓ The country distribution of smelters, refiners, and processors is elaborated from (RMI, 2023). The list of facilities includes facilities conformant with the Responsible Minerals Initiative's (RMI) standards and eligible to undergo an RMI assessment;
- ✓ The CAGR indicates the growth of primary (mining) production between 2012 and 2021.

## 91.5 Applications

Geographical scope: World.

Data source(s): (ITIA, 2018).

Reference Year: 2017.

Notes: First uses of tungsten. The breakdown of EU consumption by end-use applications is available from the EC MSA study (BIO by Deloitte, 2015).

Latest RMIS Dashboard update: August 2021.

## 91.6 Trade of primary materials

Coverage: The heading HS 261100 is employed for trade data that covers tungsten ores and concentrates (wolframite, scheelite etc.). The trade of metallurgical by-products containing mainly tungsten and used either for its extraction or as a basis for the manufacture of chemical compounds are excluded as the relevant HS heading (HS 262099) contains various by-products containing several metals and compounds.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports originating from Bolivia, DRC, Democratic People's Republic of Korea, and Vietnam are approximated from reported imports by destination countries. Mozambique's, and Ukraine's trade for 2019 is derived from declared imports and exports by reporting partners.

Relevant Harmonized System (HS) Codes: HS 261100 *Tungsten ores and concentrates*.

Latest RMIS Dashboard update: August 2021.

## 91.7 Trade of refined/processed materials

Coverage: Data shown refer to the product aggregate of HS 284180, HS 720280, HS 810194 and HS 810110. The products coverage extends from tungstates to tungsten ferroalloys, and from unwrought tungsten to tungsten powders and tungsten articles. Data for the trade of tungsten carbides and various tungsten compounds such as tungstic oxide and tungstic acid are not included due to the low granularity of the HS headings they are classified in (HS 282590; HS 282739; HS 284990; HS 285000). Tungsten products in wrought forms are excluded (HS 810196, HS 810699).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's, Mozambique's, Guyana's, and Ukraine's trade for 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 284180 *Salts; tungstates (wolframates)*; HS 720280 *Ferro-alloys; ferro-tungsten and ferro-silico-tungsten*; HS 810194 *Tungsten (wolfram); unwrought, including bars and rods obtained simply by sintering*; HS 810110 *Tungsten (wolfram); articles thereof, including waste and scrap, powders*.

Latest RMIS Dashboard update: August 2021.

## **91.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: EU28.

Data source(s): EC MSA study (BIO by Deloitte, 2015).

Reference Year: 2012.

Notes: The indicator is calculated from background data provided by the source according to the methodology described in (Peiró *et al.*, 2018).

Latest RMIS Dashboard update: August 2021.

## **91.9 Other Indicators**

- ✓ The EU sourcing (EU supply) for processing (refined materials), and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## **92 Vanadium**

### **92.1 Resources and Reserves**

#### **92.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **92.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **92.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023) .

Other sources checked and/or compiled: (WMD, 2023) (2006-2021), (USGS myb-V, 2023) (2000-2021).

Notes: Figures include primary ores and co-production from steel slag but exclude vanadium recovered as a byproduct from secondary sources and residues e.g. spent catalysts used in crude oil refining.

Latest RMIS Dashboard update: August 2021.

### **92.3 Production of refined/processed materials**

#### **92.3.1 Refined vanadium**

Coverage: World countries (2019), World total (2011-2022).

Time period of compiled data series: 2011-2022.

Reference Year: 2019.

Data source(s): (Perles, 2020b) for 2019 (by world countries), (Vanitec, 2023) for 2011-2022 (world total).

Other collected/checked/registered datasets: (Perles, 2020a) for 2016-2020, (BM, 2023) for 2021, (BM, 2021) for 2019.

Notes: The output of refined vanadium is defined as the V content in all vanadium oxides produced, plus other V-compounds (e.g. V-chemicals) that have not been produced via oxide route, plus ferrovanadium that has not been produced via V<sub>2</sub>O<sub>5</sub>-route (e.g. from certain recycling processes).

Latest RMIS Dashboard update: August 2023.

#### **92.3.2 Ferrovanadium**

Coverage: World countries.

Time period of compiled data series: 2000-2020.

Reference Year: 2020.

Data source(s): JRC elaboration based on (USGS myb-ferroalloys, 2023) and (BGS, 2023).

Other collected/checked/registered datasets:

Notes: Data for Austria, Belgium, Czechia, Japan (2000-2013), Russia (2008-2020), and Eswatini are compiled from BGS. Data for Canada, China (2000, 2012-2020), Japan (2014-2020), India, Russia (2000-2007), and South Africa are collected from USGS. The Chinese production in 2001-2011 is estimated on the basis of the CAGR between 2000 and 2012.

Latest RMIS Dashboard update: August 2023.

## 92.4 Additional information and insights about production

- ✓ The distribution of vanadium-bearing raw material sources is obtained from (BM, 2023);
- ✓ The production capacity for vanadium oxides is sourced from (Roskill, 2015b);
- ✓ The CAGR refers to refinery production between 2013 and 2022.

## 92.5 Applications

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2015.

Notes: Figures denote the distribution of consumption by first-use applications.

Latest RMIS Dashboard update: August 2021.

## 92.6 Trade of primary materials

The trade of vanadiferous concentrates (e.g. titanomagnetite (VTM) ores) and residues from the metallurgical processing of V-bearing iron ore is covered by headings HS 261590 and HS 260299, respectively, which do not have the required granularity. Therefore, no data are shown for the trade of vanadium's primary raw materials.

## 92.7 Trade of refined/processed materials

Coverage: The trade of refined/processed vanadium is specified by the product aggregate of HS 282530 and HS 720292 covering vanadium pentoxide and ferro-vanadium, respectively. Vanadium metal, vanadates and other vanadium compounds (chloride, chloride oxide, sulphate etc) are not included due to the low granularity of the respective HS headings.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Iran's and Ukraine's trade for 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 282530 *Vanadium oxides and hydroxides*; HS 720292 *Ferro-alloys; ferro-vanadium*.

Latest RMIS Dashboard update: August 2021.

## 92.8 End-of-Life Recycling Input Rate (EOL-RIR)

Geographical scope: EU.

Data source(s): EC MSA study (Matos *et al.*, 2021).

Reference Year: 2016.

Notes: The indicator is calculated from background data reported by the source in line with the methodology defined by (Peiró *et al.*, 2018) and (Matos, Wittmer, *et al.*, 2020).

Latest RMIS Dashboard update: August 2021.

## **92.9 Other Indicators**

- ✓ The Import Reliance for extraction (primary materials) is assumed 100% as there is no production of vanadium ores and concentrates in the EU.

## 93 Vermiculite

### 93.1 Resources and Reserves

Estimates of global resources are not available. The compiled information for global reserves is limited and with a partial country coverage; therefore, no figures are displayed. (USGS, 2023) (Kogel *et al.*, 2006).

### 93.2 Production of primary materials

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source: (BGS, 2023).

Other data sources checked and/or compiled: (USGS myb-vermiculite, 2022) (2000-2021), (WMD, 2023) (2006-2021)

Notes: Uzbekistan's production is sourced from (USGS myb-vermiculite, 2022) in 2016-2021.

Latest RMIS Dashboard update: August 2023.

### 93.3 Production of refined/processed materials

No information is available on the production of exfoliated vermiculite.

### 93.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 93.5 Applications

Geographical scope: United States.

Data source: (USGS myb-vermiculite, 2022)

Reference Year: 2021.

Notes: End-use market shares. EU-specific data are unavailable; therefore, it is assumed that the figures are applicable in the EU.

Latest RMIS Dashboard update: August 2023.

### 93.6 Trade of primary materials

Coverage: World countries.

Data source: JRC estimation based on background data from (WITS, 2021)

Reference Year: 2019.

Notes: Data from heading HS 253010 were used for the estimation of vermiculite-specific flows. The split of vermiculite flows from other materials contained within HS 253010 is achieved after assessing production for perlite and vermiculite reported by (BGS, 2023) and unit prices. Iran's, Mozambique's, and Ukraine's trade for 2019 is derived from declared imports and exports by trade partners. Chlorites' trade is not considered.

Relevant Harmonized System (HS) Codes: HS 253010 *Vermiculite, perlite and chlorites; unexpanded.*

Latest RMIS Dashboard update: August 2023.

### **93.7 Trade of refined/processed materials**

No data are obtainable from international statistics. The trade of exfoliated vermiculite is reported under heading HS 680620 that contains mineral products of several raw materials.

### **93.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Data to estimate the EOL-RIR in the EU are missing.

### **93.9 Other Indicators**

- ✓ Vermiculite was not included in the 2023 EU assessment of Critical raw materials (CRMs)(European Commission, 2023); therefore, no figures are shown for the EU sourcing and Import Reliance

## **94 Wollastonite**

### **94.1 Resources and Reserves**

Robust resource and reserve information is not available. (USGS, 2023) (Kogel *et al.*, 2006).

### **94.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other data sources checked and/or compiled: (USGS myb-Wollastonite, 2021) (2000-2018)

Notes: Data may include crude and processed (refined) wollastonite. The production of Canada in 2014-2021 is sourced from (USGS myb-Wollastonite, 2021), (USGS, 2021), (USGS, 2022), and (USGS, 2023). Spain's production in 2006 is assumed equal to 2005.

Latest RMIS Dashboard update: August 2023.

### **94.3 Production of refined/processed materials**

Processed wollastonite of higher purity (refined wollastonite) is classified as a primary raw material.

### **94.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **94.5 Applications**

Geographical scope: World

Data source: (Nair and Sairam, 2021)

Reference Year: 2013

Notes: End-use market shares. EU-specific data are not available; therefore, it is hypothesised that the figures are appropriate for the EU.

Latest RMIS Dashboard update: August 2023.

### **94.6 Trade of primary materials**

Data are not available as wollastonite's trade is reported under the generic code HS 253090 that includes multiple mineral commodities.

### **94.7 Trade of refined/processed materials**

Data are not available as wollastonite's trade is reported under the generic code HS 253090 that includes multiple mineral commodities.



## **94.8 End-of-Life Recycling Input Rate (EOL-RIR)**

There is lack of information to calculate the EOL-RIR in the EU.

## **94.9 Other Indicators**

- ✓ Wollastonite was not screened in the 2023 EU assessment of Critical raw materials (European Commission, 2023); thus, no figures are displayed for EU sourcing and Import Reliance.

## **95 Xenon**

### **95.1 Resources and Reserves**

Not applicable. Xenon is only present in the air in trace amounts and is recovered as by-product in air separation units.

### **95.2 Production of primary materials**

Not applicable. Xenon is obtained from air in air separation units by fractional separation of liquefied air.

### **95.3 Production of refined/processed materials**

#### **95.3.1 Xenon gas**

Coverage: World total.

Time period of compiled data series: 2000-2017.

Reference Year: 2017.

Data source(s): (Elsner, 2018).

Other collected/checked/registered datasets: -

Notes: Publicly-available and country-specific production data are insufficient to present the global distribution of production by countries.

Latest RMIS Dashboard update: August 2023.

### **95.4 Additional information and insights about production**

- ✓ The rare gas output distribution is derived from (Elsner, 2018);
- ✓ The calculation of CAGR concerns the production of xenon between 2008 and 2017.

### **95.5 Applications**

Geographical scope: World.

Data source(s): (Elsner, 2018) .

Reference Year: 2017.

Notes: Data show the allocation of demand by end uses. EU-specific information is not available.

Latest RMIS Dashboard update: August 2023.

### **95.6 Trade of primary materials**

Not applicable.

### **95.7 Trade of refined/processed materials**

No data are available. The HS nomenclature does not provide the required level of detail to allow tracking of xenon trade flows (xenon trade is reported in HS 280429 among other rare gases).

### **95.8 End-of-Life Recycling Input Rate (EOL-RIR)**

No data are available to compute/estimate the indicator.

### **95.9 Other Indicators**

-

## 96 Ytterbium

### 96.1 Resources and Reserves

No data have been collected (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements). Information for individual rare earth elements is not available.

### 96.2 Production of primary materials

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and ytterbium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of ytterbium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### 96.3 Production of refined/processed materials

The gathered information is not publicly available.

### 96.4 Additional information and insights about production

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### 96.5 Applications

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data reflect ytterbium's end-use demand.

Latest RMIS Dashboard update: August 2023.

### 96.6 Trade of primary materials

There are no specific codes for ytterbium in international trade statistics (HS). Their trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section section 67.6).

### **96.7 Trade of refined/processed materials**

There are no specific codes to ytterbium in international trade statistics (HS). Their trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

### **96.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Data to calculate or estimate the EOL-RIR in the EU are not available.

### **96.9 Other Indicators**

- ✓ The EU sourcing (EU supply) is sourced from (SCREEN2, 2023) and relates to all forms of ytterbium. The Import Reliance is derived from (European Commission, 2023). Both indicators refer to the average 2016-2020. More information on the scope, data, and assumptions used are provided by (SCREEN2, 2023).

## 97 Yttrium

### 97.1 Resources and Reserves

No data have been collected (see 67.1 for the distribution of resources and reserves of total Rare Earth Elements).

### 97.2 Production of primary materials

Coverage: World countries (2021), World total (2000-2020).

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): JRC analysis based on the total REE production and yttrium content in REE minerals of each operating mine.

Other collected/checked/registered datasets: -

Notes: The mine production of yttrium is estimated from the allocation of total REE production (see 67.2) to every operating mine over 2000-2021 and the grade of Rare Earth Elements in individual deposits. Information on the relative distribution of in-situ rare-earth oxides in mined REE deposits is collected from several sources such as (Alves Dias *et al.*, 2020), (USGS myb-REE, 2022), (TMR, 2015) etc. Information about the operation and output of individual REE mines is sourced from (S&P, 2023) and other sources.

Latest RMIS Dashboard update: August 2023.

### 97.3 Production of refined/processed materials

The compiled information is not publicly available.

### 97.4 Additional information and insights about production

- ✓ The CAGR concerns primary (mining) production (2012-2021).

### 97.5 Applications

Geographical scope: Europe.

Data source(s): (Wood Mackenzie, 2022a).

Reference Year: 2021.

Notes: Data demonstrate the distribution of yttrium's end-use demand.

Latest RMIS Dashboard update: August 2023.

### 97.6 Trade of primary materials

No data can be extracted from international trade statistics for yttrium's primary raw materials. Yttrium's trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of primary materials in section 67.6).

### **97.7 Trade of refined/processed materials**

There are no specific codes to yttrium in international trade statistics (HS). Its trade flows are reported in HS headings clustered with other REE without granular detail (see the generic notes for REE's trade of refined/processed materials in section 67.7).

### **97.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Available data from the EC MSA study (BIO by Deloitte, 2015) for yttrium's EOL-RIR are disregarded as they are not consistent with additional sources of information (the indicator is calculated at 31% for year 2013 based on the MSA data).

### **97.9 Other**

- ✓ The EU sourcing (EU supply) and the Import Reliance are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **98 Zinc**

### **98.1 Resources and Reserves**

#### **98.1.1 Resources**

Data source(s): JRC elaboration based on (Mudd *et al.*, 2017) and (S&P, 2022).

Reference Year: 2021.

Notes: Data from two different sources are combined and compared to achieve a thorough and updated coverage.

Latest RMIS Dashboard update: August 2023.

#### **98.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023

### **98.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other sources checked and/or compiled: (ILZSG, 2022) (2016-2021), (BGS, 2023) (2006-2021).

Notes: Mine production of zinc.

Latest RMIS Dashboard update: August 2021.

### **98.3 Production of refined/processed materials**

#### **98.3.1 Refined Zinc**

Coverage: World countries.

Time period of compiled data series: 2000-2021.

Reference Year: 2021.

Data source(s): (BGS, 2023).

Other collected/checked/registered datasets: (ILZSG, 2022) (2016-2021), (USGS myb-Zn, 2023) (2013-2021).

Notes: On the basis of collected background information, data correspond to the production of refined zinc metal by smelters or refineries regardless of the type of source material, i.e. primary (ores and concentrates) or secondary sources (scrap, residues, slag). Remelted zinc and zinc dust are excluded.

Latest RMIS Dashboard update: August 2023.

### **98.4 Additional information and insights about production**

- ✓ The distribution of the main commodities extracted in the zinc-producing mines is derived from (S&P, 2023);



- ✓ The output of refined zinc by source is obtained from (USGS myb-Zn, 2023);
- ✓ The CAGR is associated with refined zinc (2012-2021).

## 98.5 Applications

Geographical scope: Europe.

Data source(s): (Oakdene Hollins, 2017a).

Reference Year: 2015.

Notes: First uses of zinc. Data refer to 13 EU countries + UK + Norway, accounting for more than 90% of zinc use in the EU and EFTA region.

Latest RMIS Dashboard update: August 2021.

## 98.6 Trade of primary materials

Coverage: Data comprise the aggregated value of HS 260800, HS 262011 and HS 262019. Except for zinc ores and concentrates (HS 260800), metallurgical residues are allocated in the product aggregate of zinc's primary materials, i.e. hard zinc spelter residue from galvanising baths (HS 262011) and residues of zinc metallurgy (HS 262019) destined for zinc recovery or the manufacture of chemical compounds. Zinc contained in copper, lead, silver, and gold ores and concentrates and their metallurgical residues cannot be traced by the HS nomenclature.

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Exports from Algeria, Argentina, Bolivia, Burkina Faso, Cuba, Eritrea, Myanmar and Tajikistan are derived from reported imports by destination countries. Dominican Republic's, Mozambique's, Iran's and Ukraine's trade for 2019 is derived from declared imports and exports by trade partners.

Relevant Harmonized System (HS) Codes: HS 260800 *Zinc ores and concentrates*; HS 262011 *Slag, ash and residues; (not from the manufacture of iron or steel), containing mainly zinc, hard zinc spelter*; HS 262019 *Slag, ash and residues; (not from the manufacture of iron or steel), containing mainly zinc, other than hard zinc spelter*.

Latest RMIS Dashboard update: August 2021.

## 98.7 Trade of refined/processed materials

Coverage: For the global trade of zinc's refined/processed materials, the product aggregate of HS 281700, HS 790111, HS 790112, HS 790120, HS 790310, and HS 790390 are considered, corresponding to zinc oxides, unwrought zinc and zinc alloys, zinc dust, and zinc powders & flakes, correspondingly. Various zinc compounds such as artificial zinc sulphide, zinc hydroxide and zinc chloride are not included as the HS headings in which they are classified contain several substances. Unwrought brass is excluded from the product aggregate (HS 740321), as it is assigned to copper.

Data source(s): (WITS, 2021)

Reference Year: 2021

Notes: Iran's, Mozambique's, Guyana's, and Ukraine's trade for 2019 is derived from declared imports and exports by trade partners. Exports from Bangladesh and other producing countries which do not report trade flows to WITS/Comtrade are estimated from the declared imports by destination countries.

Relevant Harmonized System (HS) Codes: HS 281700 *Zinc oxide; zinc peroxide*; HS 790111 *Zinc; unwrought, (not alloyed), containing by weight 99.99% or more of zinc*; HS 790112 *Zinc; unwrought, (not alloyed), containing by weight less than 99.99% of zinc*; HS 790120 *Zinc; unwrought, alloys*; 790310 *Zinc dust*; 790390 *Zinc; powders and flakes*.

Latest RMIS Dashboard update: August 2021

## **98.8 End-of-Life Recycling Input Rate (EOL-RIR)**

Geographical scope: World.

Data source(s): JRC elaboration based on background data from (Rostek *et al.*, 2022)

Reference Year: 2019.

Notes: It is presumed that the figure is also appropriate for the EU.

Latest RMIS Dashboard update: August 2023.

## **98.9 Other Indicators**

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction and processing (primary and refined materials, respectively) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCRREEN2, 2023).

## **99 Zirconium**

### **99.1 Resources and Reserves**

#### **99.1.1 Resources**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral resources estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

#### **99.1.2 Reserves**

Data source(s): (S&P, 2022).

Reference Year: 2021.

Notes: The mineral reserves estimates are mostly based on CRIRSCO reporting standards.

Latest RMIS Dashboard update: August 2023.

### **99.2 Production of primary materials**

Coverage: World countries.

Time period of compiled data series: 2000-2021

Reference Year: 2021.

Data source(s): (WMD, 2023) for 2006-2021, (BGS, 2023) for 2000-2005.

Other sources checked and/or compiled: (BGS, 2023) (2006-2021) (USGS myb-Zr&Hf, 2023) (2006-2020).

Notes: -

Latest RMIS Dashboard update: August 2021.

### **99.3 Production of refined/processed materials**

Production statistics are not available for refined zirconium metal and compounds.

### **99.4 Additional information and insights about production**

- ✓ The CAGR refers to primary (mining) production (2012-2021).

### **99.5 Applications**

Geographical scope: World.

Data source(s): (BRGM, 2018), data from TZMI, Société Chimique de France.

Reference Year: 2015.

Notes: Data relate to end-use applications of zirconium. EU-specific data are not available and figures are assumed to be applicable to the EU.

Latest RMIS Dashboard update: August 2021.

## 99.6 Trade of primary materials

Coverage: Data refer to HS 261510 covering zircon and zircon sands (zirconium silicates) and baddeleyite (zirconium oxide).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: Ukraine's and Mozambique's trade data are obtained from reported trade flows by trade partners.

Relevant Harmonized System (HS) Codes: HS 261510 *Zirconium ores and concentrates*

Latest RMIS Dashboard update: August 2021.

## 99.7 Trade of refined/processed materials

Coverage: Data are associated to HS 810920 covering unwrought zirconium and zirconium powders. Fused zirconia (zirconium dioxide), ferro-zirconium and other zirconium compounds are not included due to the insufficient detail of the relevant HS headings (e.g. HS 282560, HS 720299). Wrought zirconium articles are excluded (HS 810990).

Data source(s): (WITS, 2021).

Reference Year: 2019.

Notes: -

Relevant Harmonized System (HS) Codes: HS 810920 *Zirconium; unwrought, powders.*

Latest RMIS Dashboard update: August 2021.

## 99.8 End-of-Life Recycling Input Rate (EOL-RIR)

Robust data for the calculation of the EOL-RIR of zirconium are not available. An approximate figure for the EOL-RR (12%) is provided by (European Commission, 2020b).

## 99.9 Other Indicators

- ✓ The EU sourcing (EU supply) and the Import Reliance for extraction (primary materials) are sourced from (European Commission, 2023) and refer to the average 2016-2020. More information on the scope, data, and assumptions used can be found in (SCREEN2, 2023).

## References

- Alkane (2017) 'Hafnium: Cleaner power and transport Faster, more energy efficient next gen devices. Data from Roskill', *Presentation at the 6th Annual Cleantech & Technology Metals Summit, 15-16/5/2017*. Toronto. Available at: <https://www.asx.com.au/asxpdf/20170516/pdf/43j8w8r75nbsgk.pdf>.
- Alkane (2018) *Zr chemicals: supply chain risks and opportunities.*, *Presentation at ZIA Annual Conference 2018*.
- Alkane (2020) *Hafnium is essential to aerospace superalloys & microchips*. Available at: <https://asm-au.com/wp-content/uploads/2020/02/Hafnium.pdf>.
- Alves Dias, P., Bobba, S., Carrara, S. and Plazzotta, B. (2020) *JRC Science for Policy report. The role of rare earth elements in wind energy and electric mobility*. Luxembourg: Publication Office of the European Union. doi: 10.2760/303258.
- Amorim, C. and Sggs, S. (2008) 'Evaluation of the environmental impacts of Cork Stoppers versus Aluminium and Plastic Closures', ... of *Cork, Aluminum and Plastic Wine Closures ...*, (October), pp. 1–126. Available at: [http://amorimcork.com/media/cms\\_page\\_media/218/Amorim\\_LCA\\_Final\\_Report.pdf](http://amorimcork.com/media/cms_page_media/218/Amorim_LCA_Final_Report.pdf).
- Anderson, C. S. (2020) *2017 Minerals Yearbook. Selenium and Tellurium*. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/selenium-and-tellurium-statistics-and-information>.
- APCOR (2015) *Cork Information Bureau 2015. Cork Sector in numbers*.
- APCOR (2019a) *Cork Yearbook 2018/2019*. Associação Portuguesa da Cortiça.
- APCOR (2019b) *Cork Yearbooks 2014-2019*. Available at: <https://www.apcor.pt/en/portfolio-posts/apcor-year-book-2020/>.
- APCOR (2020) *Cork Yearbook 2019/2020*. Associação Portuguesa da Cortiça.
- APCOR (2021) *Cork Yearbook 2020*. Associação Portuguesa da Cortiça. Available at: <https://www.apcor.pt/en/portfolio-posts/apcor-year-book-2020/>.
- Apodaca, L. E. (2022) *2018 Minerals Yearbook. Sulfur*. doi: 10.1016/j.ijporl.2012.07.018.
- Bertram, M., Ramkumar, S., Rechberger, H., Rombach, G., Bayliss, C., Martchek, K. J., Müller, D. B. and Liu, G. (2017) 'A regionally-linked, dynamic material flow modelling tool for rolled, extruded and cast aluminium products', *Resources, Conservation and Recycling*, 125(June), pp. 48–69. doi: 10.1016/j.resconrec.2017.05.014.
- BGS (2021) *World mineral statistics data, British Geological Survey*. Available at: <https://www.bgs.ac.uk/mineralsuk/statistics/wms.cfc?method=searchWMS>.
- BGS (2023) *World mineral statistics data, British Geological Survey*. Available at: <https://www2.bgs.ac.uk/mineralsuk/statistics/wms.cfc?method=searchWMS> (Accessed: 5 May 2023).
- BIO by Deloitte (2015) *Study on Data for a Raw Material System Analysis: Roadmap and Test of the Fully Operational MSA for Raw Materials. Prepared for the European Commission, DG GROW*. Available at: <https://ec.europa.eu/jrc/en/scientific-tool/msa>.
- Blengini, G. A. et al. (2017) *Assessment of the Methodology for Establishing the EU List of Critical Raw Materials. Background Report*. Luxembourg: Publications Office of the European Union. doi: 10.2760/73303.
- BM (2021) *Bushveld Minerals website. Supply. Roskill data*. Available at: <https://www.bushveldminerals.com/about-vanadium/> (Accessed: 6 December 2021).
- BM (2023) *Bushveld Minerals website. Supply*. Available at: <https://www.bushveldminerals.com/about-vanadium/> (Accessed: 13 June 2023).
- BMI (2021) *Anode Market Assessment, November 2021*. Available at: <https://www.benchmarkminerals.com/about/>.
- De Boer, M. A., Wolzak, L. and Slootweg, J. C. (2019) *Phosphorus Recovery And Recycling*. Edited by H. Ohtake and S. Tsuneda. doi: 10.1007/978-1-4612-3418-0\_4.
- BP (2020) *BP Statistical Review of World Energy 2020 (69th edition)*. Available at: <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical->

review/bp-stats-review-2020-full-report.pdf.

BP (2022) *BP Statistical Review of World Energy 2022 (71st edition)*. Available at: <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf>.

Brennan, S. T., Rivera, J. L., Varela, B. A. and Park, A. J. (2021) 'National assessment of helium resources within known natural gas reservoirs', *USGS Scientific Investigations Report 2021-585*. doi: 10.3133/sir20215085.

BRGM (2012) 'Panorama 2011 du marché du tantale', *Brgm/Rp-61343-Fr*, p. 91.

BRGM (2016) 'Le béryllium (Be) – éléments de criticité'. French Geological Survey. Available at: <https://www.mineralinfo.fr/sites/default/files/documents/2020-12/fichecriticiteberyllium-publique161026.pdf>.

BRGM (2017a) 'Le scandium (Sc) – éléments de criticité', (2016), pp. 1–6. Available at: <https://www.mineralinfo.fr/sites/default/files/documents/2020-12/fichecriticitescandium180102.pdf>.

BRGM (2017b) *Le titane (Ti) – éléments de criticité*. Bureau de Recherches Géologiques et Minières. Available at: <https://www.mineralinfo.fr/sites/default/files/documents/2020-12/fichecriticitetitane171017.pdf>.

BRGM (2018) 'Le zirconium (Zr) – éléments de criticité'. Bureau de Recherches Géologiques et Minières. The French Geological Survey (BRGM), pp. 1–8. Available at: [http://www.mineralinfo.fr/sites/default/files/upload/documents/Fiches\\_criticite/fichecriticitezr180702.pdf](http://www.mineralinfo.fr/sites/default/files/upload/documents/Fiches_criticite/fichecriticitezr180702.pdf).

BRGM (2020a) 'Fiche de criticité - Iridium'. Available at: <https://www.mineralinfo.fr/fr/actualite/actualite/fiche-de-criticite-de-liridium-est-disponible-sur-mineralinfo>.

BRGM (2020b) 'Fiche de criticité - Tantale'.

BRGM (2020c) *Fiche de synthèse Mémento - Diatomite*. Available at: <https://www.mineralinfo.fr/fr/actualite/actualite/publication-dune-fiche-de-synthese-sur-diatomite>.

Britt, A. (2018) *Australian Resource Reviews: Bauxite 2017*. Available at: <https://ecat.ga.gov.au/geonetwork/srv/api/records/5dabf7d0-1fb6-4337-979b-3038a254e82a>.

Butcher, T. and Brown, T. (2014) 'Gallium', in *Critical Metals Handbook*, pp. 150–176. doi: <https://doi.org/10.1002/9781118755341.ch7>.

Cazzaniga, N., Jasinevicius, G., Jonsson, K. and Mubareka, S. (2021) 'Wood Resource Balances of European Union and Member States - Release 2021. Technical Brief'. Available at: [https://knowledge4policy.ec.europa.eu/publication/wood-resource-balances\\_en](https://knowledge4policy.ec.europa.eu/publication/wood-resource-balances_en).

CBMM (2019) *2018 Sustainability report*. Available at: [https://cbmm.com/-/media/CBMM/PDF/PDFs---Misc---Eng/CBMM\\_Sustainability-Report-2018.pdf](https://cbmm.com/-/media/CBMM/PDF/PDFs---Misc---Eng/CBMM_Sustainability-Report-2018.pdf).

Ciech (2023) *Salt consumption structure in Europe, based on Roskill*. Available at: <https://ciechgroup.com/en/relacje-inwestorskie/market-environment/soda-segment/evaporated-salt/> (Accessed: 8 June 2023).

CM (2018) '10-Year outlook for the global Scandium Market to 2028. CM Group presentation 28/11/2018'.

CNIA (2021) 'Titanium sponge production volume in China from 2014 to 2020.', *China's Nonferrous Metals Industry Association*, accessed through Statista. Available at: <https://www.statista.com/statistics/1072591/china-titanium-sponge-production-volume/>.

Cobalt Institute (2019) 'Production Statistics 2011-2018'. Available at: <https://www.cobaltinstitute.org/statistics.html>.

Cobalt Institute (2023) *Cobalt market report 2022*. Available at: <https://www.cobaltinstitute.org/resource/cobalt-market-report-2022/>.

Dondi, M. (2018) 'Feldspathic fluxes for ceramics: Sources, production trends and technological value', *Resources, Conservation and Recycling*, 133(February), pp. 191–205. doi: 10.1016/j.resconrec.2018.02.027.

Dondi, M. (2019a) 'Feldspar production (2012-2016). Dataset developed for the EC CRM assessment 2020'.

Dondi, M. (2019b) 'Kaolin and Kaolinitic clays production (2012-2016). Dataset developed for the EC CRM assessment 2020'.

ECHA (2010) 'Background document for Diarsenic trioxide - Document developed in the context of ECHA's

second Recommendation for the inclusion of substances in Annex XIV'. European Chemicals Agency, pp. 1–6. Available at: <https://echa.europa.eu/documents/10162/46eb55f6-b2ba-43e6-ad28-3064b89e93a5%0A>.

Elsner, H. (2015) 'Bismut - ein typisches Sondermetall. DERA Industrieworkshop Bismut. 9 July 2015'. Hannover. Available at: [www.bgr.bund.de/DERA\\_Rohstoffinformationen](http://www.bgr.bund.de/DERA_Rohstoffinformationen).

Elsner, H. (2018) *Noble gases – supply really critical? DERA Rohstoffinformationen 39*. Berlin. Available at: [https://www.deutsche-rohstoffagentur.de/DE/Gemeinsames/Produkte/Downloads/DERA\\_Rohstoffinformationen/rohstoffinformationenn-39\\_en.pdf?\\_\\_blob=publicationFile&v=2](https://www.deutsche-rohstoffagentur.de/DE/Gemeinsames/Produkte/Downloads/DERA_Rohstoffinformationen/rohstoffinformationenn-39_en.pdf?__blob=publicationFile&v=2).

Euracoal (2022) *Market Report 2022 no.1*. Available at: <https://euracoal.eu/library/coal-market-reports/>.

Eurofer (2022) *European steel in figures 2022*. Fourteenth. European Steel Association. Available at: <https://www.eurofer.eu/publications/brochures-booklets-and-factsheets/european-steel-in-figures-2022/>.

Eurogypsum (2016) 'Data provided through stakeholder consultation in EC 2017 Critical Raw Materials assessment'.

Eurogypsum (2021) 'Conclusions and recommendations to encourage circularity in the gypsum chain and in construction. 5th European Gypsum Recyclers Forum, 26 May 2021'. Available at: <https://www.eurogypsum.org/wp-content/uploads/2021/06/SEGRF-Conclusions-Recommendations-FINAL-20210609.pdf>.

Euromines (2020) 'The European Magnesite/Magnesia Industry', (January). Available at: <https://www.euromines.org/publications/the-european-magnesite-magnesia-industry-enabler-in-the-transition-to-a-low-carbon>.

European Aluminium (2018) *Environmental Profile Report. Life-Cycle inventory data for aluminium production and transformation processes in Europe*. European Aluminum Association. Available at: <https://www.european-aluminium.eu/resource-hub/environmental-profile-report-2018/>.

European Commission (2014a) *Report on critical raw materials for the EU - Critical raw materials profiles*. Available at: <https://ec.europa.eu/docsroom/documents/11911/attachments/1/translations/en/renditions/pdf>.

European Commission (2014b) *Report on critical raw materials for the EU - Non-Critical raw materials profiles*. Available at: <https://ec.europa.eu/docsroom/documents/7422/attachments/1/translations/en/renditions/native>.

European Commission (2017a) *Study on the review of the list of critical raw materials. Critical Raw Material Factsheets*. European Commission. doi: 10.2873/398823.

European Commission (2017b) *Study on the review of the list of critical raw materials. Non-Critical Raw Materials Factsheets*. European Commission. doi: 10.2873/876644.

European Commission (2020a) *Study on the EU's list of Critical Raw Materials (2020), Factsheets on Critical Raw Materials*. Publications Office of the European Union. doi: 10.2873/92480.

European Commission (2020b) *Study on the EU's list of Critical Raw Materials (2020), Factsheets on Non-Critical Raw Materials*. Publications Office of the European Union. doi: 10.2873/867993.

European Commission (2023) *Study on the Critical Raw Materials for the EU. DG GROW, European Commission*. DG GROW, European Commission. doi: 10.2873/725585.

Eurostat (2022) *Supply, transformation and consumption of solid fossil fuels [nrg\_cb\_sff]. Last update: 29-04-2022*. Available at: [https://ec.europa.eu/eurostat/databrowser/view/nrg\\_cb\\_sff/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/nrg_cb_sff/default/table?lang=en).

Eurostat (2023) 'Roundwood removals by type of wood and assortment. Updated 31/01/2023'. Available at: [https://ec.europa.eu/eurostat/databrowser/product/page/for\\_remov](https://ec.europa.eu/eurostat/databrowser/product/page/for_remov).

Eurostat Comext (2022) *Easy Comext database, International trade of goods*. Available at: <http://epp.eurostat.ec.europa.eu/newxtweb/> (Accessed: 14 March 2022).

Eurostat Prodcom (2023a) *Statistics on the production of manufactured goods. Sold production sold (data updated 15/3/2023), Prodcom - Statistics by Product*. Available at: <https://ec.europa.eu/eurostat/web/prodcom/data/database>.

Eurostat Prodcom (2023b) *Statistics on the production of manufactured goods. Total production (data updated 15/3/2023), Prodcom - Statistics by Product*. Available at:

- <https://ec.europa.eu/eurostat/web/prodcom/data/database>.
- EUsalt (2023) *Salt facts: Production*. Available at: <https://eusalt.com/about-salt/salt-production/> (Accessed: 17 July 2023).
- FAO (2020a) *Global Forest Resources Assessment. 2020 Main Report, Reforming China's Healthcare System*. Rome: Food and Agriculture Organization of the United Nations.
- FAO (2020b) *Global Forest Resources Assessment (FRA) 2020*. doi: 10.4060/ca8753en.
- FAO (2020c) *Global Forest Resources Assessment 2020: Main report*. Rome: Food and Agriculture Organization of the United Nations. doi: <https://doi.org/10.4060/ca9825en>.
- FAOSTAT (2023a) *Production statistics. Last update: January 19, 2023, Forestry Production and Trade*. Available at: <https://www.fao.org/faostat/en/#data/FO> (Accessed: 2 February 2023).
- FAOSTAT (2023b) *Production statistics on natural rubber. Last update March 24, 2023, Crops and livestock products*. Food and Agriculture Organization of the United Nations. Available at: <https://www.fao.org/faostat/en/#data/QCL> (Accessed: 31 May 2023).
- FCHO (2022) *Hydrogen Supply Capacity*. Available at: <https://www.fchobservatory.eu/observatory/technology-and-market/hydrogen-supply-capacity> (Accessed: 26 April 2023).
- Flook, R. (2018) *Global scene for non-metallurgical alumina, China Refractory & Abrasive Minerals Forum. Shanghai 10-12 September 2018*. Available at: <https://imformed.com/wp-content/uploads/2018/09/FLOOK-China-Minerals-Forum-2018-IMFORMED.pdf>.
- Fraser, J., Anderson, J., Lazuen, J., Lu, Ying; Heathman, O., Brewster, N., Bedder, J. and Masson, O. (2021) *Roskill's Study on future demand and supply security of nickel for electric vehicle batteries, JRC123439*. Publications Office of the European Union, Luxembourg. doi: 10.2760/212807.
- Frenzel, M., Ketris, M. P. and Gutzmer, J. (2014) 'On the geological availability of germanium', *Mineralium Deposita*, 49(4), pp. 471–486. doi: 10.1007/s00126-013-0506-z.
- Gehler, S. (2013) *Overview of titanium sponge Supply. Presentation in 'Titanium Europe' March 5-7, Hamburg*. Available at: [https://titanium.org/page/tieur\\_2013\\_2017](https://titanium.org/page/tieur_2013_2017).
- Gehler, S. (2020) *World Titanium Sponge supply Situation. Presentation 16/9/2020*. Available at: <http://docplayer.net/151122695-World-titanium-sponge-supply-situation-sylvain-gehler-uktmp-chairman.html>.
- Georgitzikis, K. and D'Elia, E. (2022) *Potash: Impact assessment for supply security*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC129105>.
- Georgitzikis, K., D'Elia, E. and Garbossa, E. (2022) *Coking Coal: Impact assessment for supply security*. European Commission. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC129975>.
- Girolami, G. (2012) 'Osmium weighs in', *Nature Chemistry*, 4(11), p. 954. doi: 10.1038/nchem.1479.
- Glöser, S., Soulier, M. and Tercero Espinoza, L. A. (2013) 'Dynamic analysis of global copper flows. Global stocks, postconsumer material flows, recycling indicators, and uncertainty evaluation', *Environmental Science and Technology*, 47(12), pp. 6564–6572. doi: 10.1021/es400069b.
- Grandfield, J. (2019) 'The scandium story - Part I', *Light Metal Age*, 77(5), pp. 34–39.
- HDIN Research (2019) 'Yellow phosphorus market global review and outlook (2019)'. Available at: <https://hdinresearch.s3.us-east-2.amazonaws.com/Yellow+Phosphorus+Market+Global+Review+and+Outlook-Published+by+HDIN+Research.pdf>.
- Helvacı, C. (2005) 'Minerals/Borates', in *Encyclopedia of Geology*, pp. 510–522. doi: 10.1016/b0-12-369396-9/00279-3.
- Helvacı, C. (2017) 'Borate deposits: An overview and future forecast with regard to mineral deposits', *Journal of Boron*, 2(2), pp. 59–70. Available at: <https://dergipark.org.tr/boron/issue/31236/302668>.
- Heraeus-SFA Oxford (2022) *PGM supply-demand balance*. Available at: [https://www.heraeus.com/en/hpm/market\\_reports/precious\\_metals\\_demand/pgm\\_demand\\_supply.html](https://www.heraeus.com/en/hpm/market_reports/precious_metals_demand/pgm_demand_supply.html) (Accessed: 11 October 2022).



Heraeus - SFA Oxford (2020) 'Heraeus Precious Metals', *The Palladium Standard*, September(13). Available at: <https://www.heraeus.com/>.

Hoffmann, M., Vaszita, E., Ujaczki, É., Fekete-Kertész, L., Molnár, M., Feigl, V. and Adam, C. (2019) 'SCALE Deliverable D6.1. European inventory of Scandium containing by-products'.

HyARC (2016) *Hydrogen Plant Capacities*. Available at: <https://h2tools.org/>.

Hydrogen Europe (2022) 'Clean Hydrogen Monitor 2022'. Available at: <https://hydrogeneurope.eu/>.

IAI (2023a) *Material Flow Analysis. Alucycle tool. Data update on 09/01/2023*, *International Aluminium Institute website*. Available at: <https://alucycle.world-aluminium.org/>.

IAI (2023b) *Statistics*, *International Aluminium Institute website*. Available at: <https://international-aluminium.org/statistics/alumina-production/> (Accessed: 24 July 2023).

ICA (2022) *Stocks and Flows - Copper Alliance*, *The International Copper Association (ICA) website*. Available at: <https://copperalliance.org/policy-focus/society-economy/circular-economy/stocks-flows/> (Accessed: 2 February 2022).

ICdA (2021) *Cadmium Applications*, *International Cadmium Association (ICdA) website*. Available at: <https://www.cadmium.org/cadmium-applications> (Accessed: 6 July 2021).

ICDA (2017) *Activity Report 2017*. Available at: <https://www.icdacr.com/page.html?pageID=13>.

ICDA (2019) 'Statistical Bulletin 2019'. International Chromium Development Association.

ICSG (2022) 'The World Copper Factbook 2022. International Copper Study Group'. Available at: <https://icsg.org/copper-factbook/>.

IEA (2022a) *Global Hydrogen Review 2022*. doi: 10.1787/39351842-en.

IEA (2022b) 'Hydrogen Projects Database. Last updated October 2022'. International Energy Agency. Available at: <https://www.iea.org/data-and-statistics/data-product/hydrogen-projects-database>.

IFASat (2023) *Supply and Consumption Databases*, *International Fertiliser Association*. Available at: <https://www.ifastat.org/databases> (Accessed: 2 July 2022).

ILZSG (2022) *Lead and Zinc Statistics (accessed 24/3/2021 & 19/10/2022)*. International Lead and Zinc Study Group. Available at: <https://www.ilzsg.org/static/statistics.aspx>.

IMA Europe (2016) 'Feedback to the 2017 Criticality assesment. Data from manufacturing companies using borates.'

IMA Europe (2018) *Recycling Industrial Minerals*. Available at: [http://old.ima-europe.eu/sites/ima-europe.eu/files/publications/IMA-Europe\\_Recycling\\_Sheets\\_2018.pdf](http://old.ima-europe.eu/sites/ima-europe.eu/files/publications/IMA-Europe_Recycling_Sheets_2018.pdf) (Accessed: 20 June 2021).

IMA Europe (2019) 'Inputs and comments to the EC 2020 Critical Raw Materials assessment'.

IMOA (2013) 'Molybdenum scrap saves resources', *MolyReview*. International Molybdenum Association, (2). Available at: <https://www.imoa.info/molybdenum-media-centre/downloads/molyreview-excerpts/molyreview-issue-2013-2.php>.

IMOA (2023) *Global production & use*, *International Molybdenum Association website*. Available at: <https://www.imoa.info/molybdenum/molybdenum-global-production-use.php> (Accessed: 3 March 2023).

InMnI (2016) *2013 Public Annual Market Research Report*. International Manganese Institute. Available at: <https://www.manganese.org/market-research/public-market-research-reports/>.

InMnI (2021) *Manganese in Lithium-ion batteries. 2021 Edition*. International Manganese Institute.

ISSF (2018) *Stainless Steel in Figures*.

ITA (2020) 'Global Resources & Reserves. Security of long-term tin supply. 2020 Update.', *International Tin Association*. Available at: <https://www.internationaltin.org/wp-content/uploads/2020/02/Global-Resources-Reserves-2020-Update.pdf>.

ITA (2021) *Statistical Review 2016 - 2020*. Available at: <http://www.titanium.org/>.

ITIA (2018) *Tungsten in 2017. End-Use Consumption*. Available at: [https://itia.info/assets/files/End\\_Use\\_Analysis/2018\\_Abstract\\_End-Use\\_Consumption.pdf](https://itia.info/assets/files/End_Use_Analysis/2018_Abstract_End-Use_Consumption.pdf).

- ITinA (2021) *ITA Study – Tin surfed the pandemic wave*. International Tin Association. Available at: <https://www.internationaltin.org/ita-study-tin-surfed-the-pandemic-wave/> (Accessed: 16 February 2023).
- ITinA (2023) *Tin Recycling*. International Tin Association. Available at: <https://www.internationaltin.org/recycling/> (Accessed: 16 February 2023).
- JM (2019a) *Johnson Matthey. Market data tables 2000-2013*. Available at: <http://www.platinum.matthey.com/services/market-research/market-data-tables> (Accessed: 11 October 2019).
- JM (2019b) *Johnson Matthey. PGM Market Report May 2019*. Available at: <https://matthey.com/news/2019/pgm-market-report-may-2019-out-now> (Accessed: 16 September 2022).
- JM (2022) *Johnson Matthey. PGM Market Report May 2022*. Available at: <https://matthey.com/pgm-market-report-2022> (Accessed: 14 July 2022).
- Johnson Matthey (2022) *PGM market report. May 2022*. Available at: <http://www.platinum.matthey.com/services/market-research/pgm-market-reports>.
- JRC (2021) 'Datasets of the JRC battery raw materials and value chain tool. Internal analysis based on S&P data and several other sources assessed to be reliable e.g. company announcements and presentations, published reports etc.' Available at: <https://rmis.jrc.ec.europa.eu/analysis-of-supply-chain-challenges-49b749>.
- Kogel, J. E., Barke, J. M., Trivedi, N. C. and Krukowski, S. T. (eds) (2006) *Industrial Minerals and Rocks: Commodities, Markets and Uses*. The Society for Mining, Metallurgy, and Exploration.
- Kollert, W. and Cherubini, L. (2012) 'Teak resources and market assessment 2010.', *Food and Agriculture Organization of the United Nations (FAO). FAO Planted Forests and Trees Working Paper*. Available at: <https://www.fao.org/publications/card/en/c/e669c850-44a1-5879-960e-e784b981aa09/>.
- KU-ITTO-TeakNet (2022) *Teak in Mekong for a Sustainable Future*. Kasetsart University; International Tropical Timber Organization; TeakNet. Available at: <https://teaknet.org/publications/book1.html>.
- Liedtke, M. and Huy, D. (2018) *Rohstoffrisikobewertung - Gallium*. DERA Rohstoffinformationen 35. Edited by D. R. (DERA) in Der and Bundesanstalt für Geowissenschaften und Rohstoffe (BGR). Berlin. Available at: [https://www.deutsche-rohstoffagentur.de/DE/Gemeinsames/Produkte/Downloads/DERA\\_Rohstoffinformationen/rohstoffinformationenn-35.pdf?\\_\\_blob=publicationFile&v=2](https://www.deutsche-rohstoffagentur.de/DE/Gemeinsames/Produkte/Downloads/DERA_Rohstoffinformationen/rohstoffinformationenn-35.pdf?__blob=publicationFile&v=2).
- Lipmann (2016) 'Lipmann Walton & Co. Input to the CRM2017 assessment'.
- Liu, S., Fan, H., Santosh, M., Liu, X., Wang, Q. and Alan, R. (2023) 'Geological resources of scandium: a review from a Chinese perspective', *International Geology Review*. Taylor & Francis, 0(0), pp. 1–22. doi: 10.1080/00206814.2023.2169842.
- Lokanc, M., Eggert, R. and Redlinger, M. (2015) 'The Availability of Indium: The Present, Medium Term, and Long Term', *National Renewable Energy Laboratory (NREL)*, October, pp. 1–90. Available at: <http://www.osti.gov/servlets/purl/1327212/%0Ahttps://www.nrel.gov/docs/fy16osti/62409.pdf>.
- Louvigné, P.-F. (2021) 'Etude de veille sur le marché du titane 2018 – 2020.', *Groupe de travail 'Titane', Ministère de la Transition Ecologique et Solidaire*. Available at: <https://www.mineralinfo.fr/fr/actualite/actualite/marche-du-titane-un-metal-strategique-pour-lindustrie-europeenne-cycle-2018>.
- Machacek, E. and Kalvig, P. (2016) 'Assessing advanced rare earth element-bearing deposits for industrial demand in the EU', *Resources Policy*. Elsevier, 49(November 2018), pp. 186–203. doi: 10.1016/j.resourpol.2016.05.004.
- Matos, C. T. et al. (2021) *Material System Analysis of Nine Raw Materials: Barytes, Bismuth, Hafnium, Helium, Natural Rubber, Phosphorus, Scandium, Tantalum and Vanadium*. EUR 30704. Luxembourg: Publications Office of the European Union. doi: 10.2760/677981.
- Matos, C. T., Ciacci, L., Godoy León, M. F., Lundhaug, M., Dewulf, J., Müller, D. B., Georgitzikis, K., Wittmer, D. and Mathieux, F. (2020) *Material System Analysis of five battery-related raw materials: Cobalt, Lithium, Manganese, Natural Graphite, Nickel*. EUR 30103. Luxembourg: Publication Office of the European Union. doi: 10.2760/519827.
- Matos, C. T., Wittmer, D., Mathieux, F. and Pennington, D. (2020) *Revision of the material system analyses specifications*. Publications Office of the European Union. doi: 10.2760/374178.

- Melcher, F. and Buchholz, P. (2014) 'Germanium', in *Critical Metals Handbook*, pp. 177–203. doi: <https://doi.org/10.1002/9781118755341.ch8>.
- Midgley, S., Somaiya, R. T., Stevens, P. R., Brown, A., Kien, N. D. and Laity, R. (2015) 'Planted teak: global production and markets, with reference to Solomon Islands', *Australian Centre for International Agricultural Research (ACIAR)*, p. 92. Available at: <https://www.aciar.gov.au/publication/technical-publications/planted-teak-global-production-markets>.
- Minerals4EU (2015) *European Minerals Yearbook*. Available at: [http://minerals4eu.brgm-rec.fr/m4eu-yearbook/theme\\_selection.html](http://minerals4eu.brgm-rec.fr/m4eu-yearbook/theme_selection.html).
- MMTA (2022) 'Minor Metals Trade Association. Scandium emerges from the shadows'. Available at: <https://mmta.co.uk/2022/04/05/scandium-emerges-from-the-shadows/>.
- Mudd, G. M. and Jowitt, S. M. (2018) 'Growing global copper resources, reserves and production: Discovery is not the only control on supply', *Economic Geology*, 113(6), pp. 1235–1267. doi: 10.5382/econgeo.2018.4590.
- Mudd, G. M. and Jowitt, S. M. (2022) 'The New Century for Nickel Resources, Reserves, and Mining: Reassessing the Sustainability of the Devil's Metal', *Economic Geology*, 117(8), pp. 1961–1983. doi: 10.5382/ECONGEO.4950.
- Mudd, G. M., Jowitt, S. M. and Werner, T. T. (2017) 'The world's lead-zinc mineral resources: Scarcity, data, issues and opportunities', *Ore Geology Reviews*. Elsevier B.V., 80, pp. 1160–1190. doi: 10.1016/j.oregeorev.2016.08.010.
- Mudd, G. M., Jowitt, S. M. and Werner, T. T. (2018) 'Global platinum group element resources, reserves and mining – A critical assessment', *Science of The Total Environment*. Elsevier, 622–623, pp. 614–625. doi: 10.1016/J.SCITOTENV.2017.11.350.
- Mudd, G. M., Weng, Z., Jowitt, S. M., Turnbull, I. D. and Graedel, T. E. (2013) 'Quantifying the recoverable resources of by-product metals: The case of cobalt', *Ore Geology Reviews*. Elsevier B.V., 55(C), pp. 87–98. doi: 10.1016/j.oregeorev.2013.04.010.
- Murphy, P. and Frick, L. (2006) 'Titanium', in Kogel, J. E., Barke, J. M., Trivedi, N. C., and Krukowski, S. T. (eds) *Industrial Minerals and Rocks: Commodities, Markets and Uses*. The Society for Mining, Metallurgy, and Exploration.
- Nair, N. A. and Sairam, V. (2021) 'Research initiatives on the influence of wollastonite in cement-based construction material- A review', *Journal of Cleaner Production*. Elsevier Ltd, 283. doi: 10.1016/j.jclepro.2020.124665.
- Nassar, N. T., Kim, H., Frenzel, M., Moats, M. S. and Hayes, S. M. (2022) 'Global tellurium supply potential from electrolytic copper refining', *Resources, Conservation and Recycling*. Elsevier B.V., 184(May), p. 106434. doi: 10.1016/j.resconrec.2022.106434.
- O'Driscoll, M. (2018) 'Refractory magnesia supply update. Presentation 9/3/2018. Data from R. Flook & I. Wilson (2016)', (March). Available at: <http://cdn.ceo.ca.s3-us-west-2.amazonaws.com/1e0l3nf-M-ODriscoll-IMFORMED-Magnesia-IREFCON-2018-lo-res+%28%29.pdf>.
- Oakdene Hollins (2017a) 'Lead And Zinc First Uses in Europe. Research commissioned by the The International Lead and Zinc Study Group (ILZSG)'. Available at: [https://www.ilzsg.org/generic/pages/list.aspx?table=document&ff\\_aa\\_document\\_type=P&from=1](https://www.ilzsg.org/generic/pages/list.aspx?table=document&ff_aa_document_type=P&from=1).
- Oakdene Hollins (2017b) *Magnesium Recycling in the EU*. International Magnesium Association. Available at: [https://www.intlmag.org/page/sustain\\_eu\\_study](https://www.intlmag.org/page/sustain_eu_study).
- Passarini, F., Ciacci, L., Nuss, P. and Manfredi, S. (2018) *Material flow analysis of aluminium, copper, and iron in the EU-28*. EUR 29220. Luxembourg: Publication Office of the European Union. doi: 10.2760/1079.
- Peiró, L. T., Nuss, P., Mathieux, F. and Blengini, G. (2018) *Towards recycling indicators based on EU flows and raw materials system analysis data*. Publications Office of the European Union. doi: 10.2760/092885.
- Perles, T. (2020a) 'TTP Squared, Inc. Expert consultation in MSA (2021)'.
- Perles, T. (2020b) *Vanadium Market Analysis. 3 April 2020*. TTP Squared, Inc. Available at: [http://www.ferro-alloy.com/en/vanadium/TTP\\_Squared\\_market\\_summary\\_3\\_April\\_2020.pdf](http://www.ferro-alloy.com/en/vanadium/TTP_Squared_market_summary_3_April_2020.pdf).
- Rives, J., Fernandez-Rodriguez, I., Rieradevall, J. and Gabarrell, X. (2011) 'Environmental analysis of the

production of natural cork stoppers in southern Europe (Catalonia - Spain)', *Journal of Cleaner Production*. Elsevier Ltd, 19(2–3), pp. 259–271. doi: 10.1016/j.jclepro.2010.10.001.

RMI (2023) *Responsible Minerals Initiative. Facility database*. Available at: <http://www.responsiblemineralsinitiative.org/> (Accessed: 4 July 2023).

Roberts, J. (2018) 'Titanium metal- what will the next decade bring? Roskill's presentation in "Titanium USA 2018" 10/10/2018'. Las Vegas. Available at: <https://custom.cvent.com/C2795141339A407CA590D38C49421294/files/1c3b3c710a874970a9af1a8d3acdOde4.pdf>.

Robinson, G., Hammarstrom, J. and Olson, D. (2017) 'Graphite. U.S. Geological Survey Professional Paper 1802-J', in Schulz, K. J., DeYoung, J. H. J., II, R. R. S., and Bradley, D. C. (eds) *Critical Mineral Resources of the United States—Economic and Environmental Geology and Prospects for Future Supply*. US Geological Survey, p. 797. Available at: <https://doi.org/10.3133/pp1802>.

Rongguo, C., Juan, G., Liwen, Y., Huy, D. and Liedtke, M. (2016) *Supply and Demand of Lithium and Gallium*. Federal Institute for Geosciences and Natural Resources (BGR).

Roskill (2014) *Cobalt: Market Outlook to 2018. 12th Edition*. Available at: <https://roskill.com/market-reports/>.

Roskill (2015a) *Rhenium. Market Outlook to 2020*.

Roskill (2015b) *The World market for vanadium to 2025*. 15th edn.

Roskill (2016) *Tantalum: Global Industry, Markets & Outlook to 2020*. 12th edn.

Rostek, L., Tercero Espinoza, L. A., Goldmann, D. and Loibl, A. (2022) 'A dynamic material flow analysis of the global anthropogenic zinc cycle: Providing a quantitative basis for circularity discussions', *Resources, Conservation and Recycling*. Elsevier B.V., 180. doi: 10.1016/j.resconrec.2022.106154.

S&P (2022) *S&P Global Market Intelligence. Metals and Mining database, S&P Capital IQ*. Available at: <https://www.spglobal.com/marketintelligence/en/> (Accessed: 10 October 2022).

S&P (2023) *S&P Global Market Intelligence. Metals and Mining database, S&P Capital IQ*. Available at: <https://www.spglobal.com/marketintelligence/en/> (Accessed: 19 June 2023).

Schmitz, M. (2019) *Rohstoffrisikobewertung – Magnesium (Metall)*. DERA Rohstoffinformationen 38. Berlin. Available at: [https://www.deutsche-rohstoffagentur.de/DERA/DE/Aktuelles/rohstoff\\_magnesium.html](https://www.deutsche-rohstoffagentur.de/DERA/DE/Aktuelles/rohstoff_magnesium.html).

Schwarz-Schampera, U. (2014) 'Antimony', in Gunn, G. (ed.) *Critical Metals Handbook*, pp. 70–98. doi: <https://doi.org/10.1002/9781118755341.ch4>.

SCREEN2 (2023) *Factsheets on CRMs 2023*. Available at: <https://screen.eu/crms-2023/>.

Sierra-Pérez, J., Boschmonart-Rives, J. and Gabarrell, X. (2015) 'Production and trade analysis in the Iberian cork sector: Economic characterization of a forest industry', *Resources, Conservation and Recycling*. Elsevier B.V., 98, pp. 55–66. doi: 10.1016/j.resconrec.2015.02.011.

Soulier, M., Glöser-Chahoud, S., Goldmann, D. and Tercero Espinoza, L. A. (2018) 'Dynamic analysis of European copper flows', *Resources, Conservation and Recycling*, 129(November 2017), pp. 143–152. doi: 10.1016/j.resconrec.2017.10.013.

Statista (2022a) *Market volume of hydrofluoric acid worldwide from 2015 to 2021, with a forecast for 2022 to 2029. Data from AgileIntel Research (ChemIntel360). Published on April 2022*. Available at: <https://www.statista.com/statistics/1245196/hydrofluoric-acid-market-volume-worldwide/>.

Statista (2022b) 'Yellow phosphorus production in Vietnam from 2010 to 2021. Data from the General Statistics Office of Vietnam. Published on August 2022'. Available at: <https://www.statista.com/statistics/1003665/vietnam-yellow-phosphorus-production/>.

STDA (2023) *Se & Te, Selenium-Tellurium Development Association website*. Available at: <https://stda.org/pages/SE-%26-TE.html> (Accessed: 18 July 2023).

The Silver Institute (2016) 'World Silver Surveys 2010-2016'. Available at: <https://www.silverinstitute.org/all-world-silver-surveys/>.

The Silver Institute & Metal Focus (2020) *World Silver Survey 2020*. Available at: <https://www.silverinstitute.org/all-world-silver-surveys/>.



(revision of the classification systems published as U.S. Geological Survey Bulletin 1450–A). Available at: <http://pubs.er.usgs.gov/publication/cir831>.

USGS (2008) *Mineral Commodity Summaries 2008*. U.S. Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/mineral-commodity-summaries>.

USGS (2017) *Mineral Commodity Summaries 2017*, U.S. Geological Survey. doi: <http://dx.doi.org/10.3133/70140094>.

USGS (2021) *Mineral Commodity Summaries 2021*. United States Geological Survey (USGS). doi: [10.3133/mcs2021](https://doi.org/10.3133/mcs2021).

USGS (2022) *Mineral Commodity Summaries 2022*. Reston, VA: United States Geological Survey (USGS). doi: [10.3133/mcs2022](https://doi.org/10.3133/mcs2022).

USGS (2023) *Mineral Commodity Summaries 2023*. U.S. Geological Survey. Available at: <https://www.usgs.gov/publications/mineral-commodity-summaries-2023>.

USGS mcs (2023) 'Mineral Commodity Summaries, editions 2000–2023'. U.S. Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/mineral-commodity-summaries>.

USGS myb-Ag (2022) *Minerals Yearbook. Silver. Data release in xls format, Annual editions 2019–2020, published in 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/silver-statistics-and-information>.

USGS myb-As (2022) 'Minerals Yearbook. Arsenic. Data release in xls format', *Annual editions 2015–2021, published from 2016 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/arsenic-statistics-and-information>.

USGS myb-B (2022) 'Minerals Yearbook. Boron. Data release in xls format', *Annual editions 2010–2020, published from 2013 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/boron-statistics-and-information>.

USGS myb-barite (2022) 'Minerals Yearbook. Barite. Data release in xls format', *Annual editions 2018–2021, published from 2020 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/barite-statistics-and-information>.

USGS myb-bauxite (2022) *Minerals Yearbook. Bauxite and Alumina. Data release in xls format, Annual editions 2015–2020, published from 2017 to 2022*. U.S Geological Survey.

USGS myb-Be (2018) 'Minerals Yearbook. Beryllium (pdf format)', *Annual editions 2012–2018, published from 2016 to 2021*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/beryllium-statistics-and-information>.

USGS myb-Be (2022) 'Minerals Yearbook. Beryllium. Data release in xls format', *Annual editions 2004–2020, published from 2004 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/beryllium-statistics-and-information>.

USGS myb-Bi (2023) 'Minerals Yearbook. Bismuth. Data release in xls format', *Annual editions 2004–2021, published from 2006 to 2023*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/bismuth-statistics-and-information>.

USGS myb-Cd (2022) 'Minerals Yearbook. Cadmium. Data release in xls format', *Annual editions 2004–2020, published from 2006 to 2022*. U.S Geological Survey.

USGS myb-Clays (2022) 'Minerals Yearbook. Clays. Data release in xls format', *Annual editions 2010–2020, published from 2012 to 2022*. U.S Geolog. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/clays-statistics-and-information>.

USGS myb-Co (2023) 'Minerals Yearbook. Cobalt. Data release in xls format', *Annual editions 2004–2020, published from 2007 to 2023*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/cobalt-statistics-and-information>.

USGS myb-Cr (2022) 'Minerals Yearbook. Chromium. Data release in xls format', *Annual editions 2004–2020, published from 2005 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/chromium-statistics-and-information>.

USGS myb-Cu (2023) 'Minerals Yearbook. Copper. Data release in xls format', *Annual editions 2004–2019*,

published from 2006 to 2023. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/copper-statistics-and-information>.

USGS myb-diamond(industrial) (2023) *Minerals Yearbook. Industrial diamond. Data release in xls format, Annual editions 2004-2020, published from 2007 to 2023.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/industrial-diamond-statistics-and-information>.

USGS myb-Diatomite (2022) 'Minerals Yearbook. Diatomite. Data release in xls format', *Annual editions 2019-2021, published from 2021 to 2022.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/diatomite-statistics-and-information>.

USGS myb-feldspar (2022) *Minerals Yearbook. Feldspar. Data release in xls format, Annual editions 2017-2019, published from 2020 to 2022.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/feldspar-statistics-and-information>.

USGS myb-ferroalloys (2023) 'Minerals Yearbook. Ferroalloys. Data release in xls format', *Annual editions 2004-2020, published from 2005 to 2023.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/ferroalloys-statistics-and-information>.

USGS myb-fluorspar (2022) *Minerals Yearbook. Fluorspar. Data release in xls format, Annual editions 2016-2019, published from 20020 to 2022.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/fluorspar-statistics-and-information>.

USGS myb-Ga (2022) *Minerals Yearbook. Gallium. Data release in xls format, Annual editions 2016-2020, published from 2018 to 2022.* U.S Geological Survey.

USGS myb-Ge (2022) 'Minerals Yearbook. Germanium. Data release in xls format', *Annual editions 2015-20201 published from 2017 to 2022.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/germanium-statistics-and-information>.

USGS myb-graphite (2023) *Minerals Yearbook. Graphite. Data release in xls format, Annual editions 2004-2021, published from 2006 to 2023.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/graphite-statistics-and-information>.

USGS myb-gypsum (2023) *Minerals Yearbook. Gypsum. Data release in xls format, Annual edition 2021, published in 2023.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/gypsum-statistics-and-information>.

USGS myb-In (2023) *Minerals Yearbook. Indium. Data release in xls format, Annual editions 2004-2021, published from 2006 to 2023.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/indium-statistics-and-information>.

USGS myb-Li (2022) 'Minerals Yearbook. Lithium. Data release in xls format', *Annual editions 2004-2020, published from 2006 to 2022.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/lithium-statistics-and-information>.

USGS myb-Mg (2023) 'Minerals Yearbook. Magnesium. Data release in xls format', *Annual editions 2004-2021, published from 2006 to 2023.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/magnesium-statistics-and-information>.

USGS myb-Mg compounds (2023) *Minerals Yearbook. Magnesium compounds. Data release in xls format, Annual editions 2004-2021, published from 2005 to 2023.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/magnesium-compounds-statistics-and-information>.

USGS myb-mica (2022) 'Minerals Yearbook. Mica. Data release in xls format', *Annual editions 2004-2021, published from 2006 to 2022.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/mica-statistics-and-information>.

USGS myb-Mn (2023) *Minerals Yearbook. Manganese. Data release in xls format, Annual editions 2004-2021, published from 2006 to 2023.* U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/manganese-statistics-and-information>.

USGS myb-Mo (2023) 'Minerals Yearbook. Molybdenum. Data release in xls format', *Annual editions 2004-2021, published from 2006 to 2023.* U.S Geological Survey. Available at:

<https://www.usgs.gov/centers/national-minerals-information-center/molybdenum-statistics-and-information>.

USGS myb-Nb (2013) 'Minerals Yearbook. Niobium. Data release in xls format', *Annual editions 2004-2011, published from 2005 to 2013*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/niobium-and-tantalum-statistics-and-information>.

USGS myb-Nb (2022) 'Minerals Yearbook. Niobium. Data release in xls format', *Annual editions from 2007 to 2021, published from 2010 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/niobium-and-tantalum-statistics-and-information>.

USGS myb-Ni (2023) 'Minerals Yearbook. Nickel. Data release in xls format', *Annual editions 2004-2019, published from 2007 to 2023*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/nickel-statistics-and-information><https://www.usgs.gov/centers/national-minerals-information-center/nickel-statistics-and-information>.

USGS myb-Pb (2022) 'Minerals Yearbook. Lead. Data release in xls format', *Annual editions 2018-2019, published in 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/lead-statistics-and-information>.

USGS myb-perlite (2022) *Minerals Yearbook. Perlite. Data release in xls format, Annual editions 2004-2021, published from 2007 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/perlite-statistics-and-information>.

USGS myb-PGM (2023) 'Minerals Yearbook. Platinum-Group Metals. Data release in xls format', *Annual editions 2004-2021, published from 2007 to 2023*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/platinum-group-metals-statistics-and-information>.

USGS myb-phosphate (2022) *Minerals Yearbook. Potash. Data release in xls format, Annual editions 2018-2020, published from 2019 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/phosphate-rock-statistics-and-information>.

USGS myb-potash (2022) *Minerals Yearbook. Potash. Data release in xls format, Annual editions 2004-2021, published from 2007-2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/potash-statistics-and-information>.

USGS myb-pumice (2022) 'Minerals Yearbook. Pumice and Pumicite. Data release in xls format', *Annual editions 2004-2021, published from 2007 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/pumice-and-pumicite-statistics-and-information>.

USGS myb-Re (2021) 'Minerals Yearbook 2018. Rhenium'. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/rhenium-statistics-and-information>.

USGS myb-Re (2022) 'Minerals Yearbook. Rhenium. Data release in xls format', *Annual editions 2019-2021, published from 2021 to 2023*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/rhenium-statistics-and-information>.

USGS myb-REE (2022) *Minerals Yearbook. Rare Earths. Data release in xls format, Annual editions 2004-2019 published from 2006 to 2022*. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/rare-earths-statistics-and-information>.

USGS myb-S (2023) 'Minerals Yearbook. Sulfur. Data release in xls format', *Annual editions 2004-2021, published from 2006 to 2023*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/sulfur-statistics-and-information>.

USGS myb-salt (2023) 'Minerals Yearbook. Salt. Data release in xls format', *Annual editions 2004-2019, published from 2005 to 2023*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/salt-statistics-and-information>.

USGS myb-Sb (2022) 'Minerals Yearbook. Antimony. Data release in xls format', *Annual editions 2004-2018, published from 2006 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/antimony-statistics-and-information>.

USGS myb-Se&Te (2022) *Minerals Yearbook. Selenium & Tellurium. Data release in xls format, Annual*



editions 2004-2020, published from 2005 to 2022. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/selenium-and-tellurium-statistics-and-information>.

USGS myb-Si (2022) 'Minerals Yearbook. Silicon. Data release in xls format', *Annual editions 2013-2021, published from 2009 to 2021*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/silicon-statistics-and-information>.

USGS myb-Silica (2022) *Minerals Yearbook. Silica. Data release in xls format*. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/silica-statistics-and-information>.

USGS myb-Sn (2022) 'Minerals Yearbook. Tin. Data release in xls format', *Annual editions 2004-2020, published from 2006 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/tin-statistics-and-information>.

USGS myb-Sr (2022) 'Minerals Yearbook. Strontium. Data release in xls format', *Annual editions 2004-2021, published from 2006 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/strontium-statistics-and-information>.

USGS myb-Ta (2022) *Minerals Yearbook. Tantalum. Data release in xls format, Annual editions 2004-2021, published from 2007 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/niobium-and-tantalum-statistics-and-information>.

USGS myb-talc (2022) 'Minerals Yearbook. Talc and Pyrophyllite. Data release in xls format', *Annual editions 2018-2021, published from 2020 to 2022*.

USGS myb-Ti (2023) 'Minerals Yearbook. Titanium. Data release in xls format', *Annual edition 2020, published in 2023*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/titanium-statistics-and-information>.

USGS myb-V (2023) 'Minerals Yearbook. Vanadium. Data release in xls format', *Annual editions 2004-2021, published from 2006 to 2023*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/vanadium-statistics-and-information>.

USGS myb-vermiculite (2022) *Minerals Yearbook. Vermiculite. Data release in xls format, Annual editions 2004-2021, published from 2007 to 2022*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/vermiculite-statistics-and-information>.

USGS myb-W (2021) 'Minerals Yearbook. Tungsten. Data release in xls format', *Annual editions 2004-2019, published from 2008 to 2021*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/tungsten-statistics-and-information>.

USGS myb-Wollastonite (2021) *Minerals Yearbook. Wollastonite (pdf format), Annual editions 2004-2018, published from 2007 to 2021*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/wollastonite-statistics-and-information>.

USGS myb-Zn (2023) *Minerals Yearbook. Zinc. Data release in xls format, Annual editions 2017-2021, published from 2020 to 2023*. U.S Geological Survey. Available at: <https://www.usgs.gov/centers/national-minerals-information-center/zinc-statistics-and-information>.

USGS myb-Zr&Hf (2023) *Minerals Yearbook. Zirconium and Hafnium. Data release in xls format, Annual editions 2010-2020, published from 2012 to 2023*. U.S Geological Survey.

Vanitec (2023) *Production and Consumption. 2011 – 2022 Vanadium Statistics*. Available at: 20/6/2023.

VDKI (2017) *Annual Report 2017*. Verein der Kohlenimporteure. Available at: <https://english.kohlenimporteure.de/publications/annual-report-2018.html>.

VDKI (2022) *Annual Report 2021*. Available at: <https://euracoal.eu/library/coal-market-reports/>.

Wang, Z., Li, M. Y. H., Liu, Z. R. R. and Zhou, M. F. (2021) 'Scandium: Ore deposits, the pivotal role of magmatic enrichment and future exploration', *Ore Geology Reviews*. Elsevier B.V., 128(December 2020), p. 103906. doi: 10.1016/j.oregeorev.2020.103906.

Werner, T. T., Mudd, G. M. and Jowitt, S. M. (2017) 'The world's by-product and critical metal resources part III: A global assessment of indium', *Ore Geology Reviews*, 86. doi: 10.1016/j.oregeorev.2017.01.015.

WGC (2022) *World Gold Council. Global mine production. Last updated 9/6/2022*. Available at:

<https://www.gold.org/goldhub/data/gold-production-by-country> (Accessed: 11 May 2023).

WGC (2023) *World Gold Council. Historical demand and supply. Last updated 5/5/2023*. Available at: <https://www.gold.org/goldhub/data/gold-supply-and-demand-statistics> (Accessed: 11 May 2023).

Willis, P., Chapman, A., Fryer, A., Bryson, R. and Morley, C. (2012) *Study of By-Products of Copper, Lead, Zinc and Nickel Oakdene*. Available at: <https://www.ilzsg.org/publications-list/>.

Wilson, I. (2015) 'Global resources and production of magnesite', *Industrial Minerals*. Available at: <https://www.indmin.com/Article/3483724/Global-resources-and-production-of-magnesite.html>.

WITS (2021) *World Integrated Trade Solution. International merchandise trade data*. Available at: <https://wits.worldbank.org/> (Accessed: 21 June 2021).

WITS (2023) *World Integrated Trade Solution. International merchandise trade data*. Available at: <https://wits.worldbank.org/> (Accessed: 7 February 2023).

WMD (2023) *World Mining Data*. 2012th–2023rd edn. Edited by M. S. C. Reichl. Vienna: Austrian Federal Ministry of Agriculture, Regions and Tourism (BMLRT). Available at: [https://www.world-mining-data.info/?World\\_Mining\\_Data\\_\\_\\_PDF-Files](https://www.world-mining-data.info/?World_Mining_Data___PDF-Files).

Wood Mackenzie (2022a) 'Global rare earths investment horizon outlook - Q4 2022', (December). Available at: <https://www.woodmac.com/>.

Wood Mackenzie (2022b) 'Global rare earths short-term outlook November 2022', (November). Available at: <https://www.woodmac.com/>.

WorldStainless (2020) *Stainless and heat-resisting steel melt shop production*.

WorldStainless (2023) *Stainless and heat-resisting steel melt shop production*. International Stainless Steel Forum.

WorldSteel (2018) *Steel Statistical Yearbook. 2010-2018 Editions*. World Steel Association. Available at: <https://worldsteel.org/steel-topics/statistics/steel-statistical-yearbook/>.

WorldSteel (2022a) *Crude Steel Production*. World Steel Association. Available at: <https://worldsteel.org/steel-topics/statistics/steel-data-viewer/> (Accessed: 4 June 2023).

WorldSteel (2022b) *World Steel in Figures. Editions 2020-2022*. World Steel Association. Available at: <https://worldsteel.org/steel-topics/statistics/world-steel-in-figures/>.

WorldSteel (2023a) *Crude Steel Production. Last updated on 22 February 2023*. World Steel Association. Available at: <https://worldsteel.org/steel-topics/statistics/steel-data-viewer/> (Accessed: 3 March 2023).

WorldSteel (2023b) *World Steel in figures 2023*. World Steel Association. Available at: <https://worldsteel.org/steel-topics/statistics/world-steel-in-figures/>.

WPIC (2022) 'World Platinum Investment Council. Supply & Demand. Q4'22 forecast'. Available at: <https://platinuminvestment.com/supply-and-demand/platinum-quarterly>.

Zhou, Q. and Damm, S. (2020) *Supply and Demand of Natural Graphite - DERA Rohstoffinformationen 43*. Berlin. Available at: [https://www.bgr.bund.de/DE/Gemeinsames/Produkte/Downloads/DERA\\_Rohstoffinformationen/rohstoffinformationen-43.pdf?\\_\\_blob=publicationFile&v=3](https://www.bgr.bund.de/DE/Gemeinsames/Produkte/Downloads/DERA_Rohstoffinformationen/rohstoffinformationen-43.pdf?__blob=publicationFile&v=3).

Zinke, R. K. and Werkheiser, W. H. (2017) 'Titanium. U.S. Geological Survey Professional Paper 1802', in Klaus J. Schulz, John H. DeYoung, Jr., Robert R. Seal II, D. C. B. (ed.) *Critical Mineral Resources of the United States — Economic and Environmental Geology and Prospects for Future Supply*. Available at: <https://pubs.er.usgs.gov/publication/pp1802T>.