# Adjustments related to content of the considered HS codes

Some of the considered 6-digit HS codes cover materials/products that are not only part of the considered supply chains but also used within other supply chains. To identify whether the covered materials/products are constituents of the analyzed supply chain, information provided by the World Customs Organization (2021) has been used. If parts of materials/products that do not belong to the specific raw material supply chain are covered by the HS code, the content of this HS code has been adjusted. Adjustments have been done based on global average market shares and global average cost-to-mass ratios. To simplify the procedure of adjusting the HS codes content, considered market shares are generally applied to both the trade amounts and the trade costs of materials/products. It is thus assumed that materials/products covered within the same HS code have equal cost-to-mass ratios. The adjustments necessary in the frame of this case study are described in the following paragraphs.

**Lithium-ion batteries (LIBs) covered by the HS code 850760:**

Following the average market shares of LIBs for different end-use sectors stated by Tsiropoulos et al. (2018) and U.S. Department of Energy (2020), it is estimated that 60% of globally traded LIBs are used in the mobility sector. Following Tsiropoulos et al. (2018), it is assumed that 25% of globally produced LIBs are used in the ICT sector.

**Lamps covered by the HS code 853932:**

According to Fortune Business Insights (2022), the global automotive lighting market size was 37.74 billion US$ in 2020 and, according to Fortune Business Insights (2020), the global lighting market size is 12.42 billion US$ in 2020. A market share of around 30% is thus estimated for automotive lighting.

**Hydraulic engines covered by the HS code 841221:**

The share of hydraulic engines and motors used in the transportation sector is estimated with 9% based on the information provided by Gardner Denver (2017).

**Wiring covered by the HS code 854430:**

Following the wiring market data reported by Markets and Markets (2019), Market Reports World (2021) and The Business Research Company (2020), it is estimated that 79% of the vehicle, ship and aircraft wiring is used in the mobility sector.

**Electronics covered by the HS codes 854231, 854232, 854233, 853221, 853222, 853223, 853224, 853400, 853710 and 853610:**

Following Grand View Research (2021b), it is estimated that 10% of the globally traded electronics are used in the mobility sector and 30% of the globally traded electronics are used in consumer electronics and thus in the ICT sector.

**Instrumental panels covered by the HS code 910400:**

According to Verified Market Research (2021), the automotive control panel market size was 102.08 billion US$ in 2020. Due to missing further information, it is assumed that the market size of automotive control panels is 70% of the market size for vehicles, aircraft, spacecraft and vessels.

**Hydraulic fluids covered by the HS code 381900:**

Following Grand View Research (2020b), it is estimated that 20% of the globally traded hydraulic fluids are used in the mobility sector.

**Antifreezing fluids covered by the HS code 382000:**

Following Grand view Research (2016b), it is estimated that 80% of the globally traded antifreezing fluids are used in the mobility sector.

**Washing fluids covered by the HS code 340220:**

Following Grand View Research (2018c), the authors best guess is that 1% of the globally traded washing fluids are used in the mobility sector.

**Glues covered by the HS code 350610:**

Following Mordor Intelligence (2019), it is estimated that 10% of the globally traded glues are used in the mobility sector.

**Electric motors covered by the HS codes 850132, 850133, 850152, 850153 and 850440:**

According to Grand View Research (2021a), 40.5% of electric motors are used in motor vehicles in 2020.

**Lead-acid batteries (PbAcBs) within piston starting engines covered by the HS code 850710:**

Based on Transparency Market Research (2020), the authors best guess is that 90% of the piston starting engines, in which PbAcBs are applied, are used in the mobility sector.

**Internal combustion engines covered by the HS codes 840820, 840731, 840732, 840733, 840734, 842123, 841231 and 841239 as well as internal combustion engine equipment covered by the HS codes 851110, 851120, 851130, 851140, 851150 and 841330:**

Following Million Insights (2020), it is estimated that 65% of the internal combustion engines are used in the mobility sector.

**Battery cells and cases covered by the HS code 850790:**

Following U.S. Department of Energy (2020) and Tsiropoulos et al. (2018), the market shares of LIBs are estimated with 60% in mobility sector, 5% in energy sector and 25% in ICT sector. Following Grand View Research (2018e), the market shares of lead-acid batteries are estimated with 50% in mobility sector and 25% in energy sector. Following Global Research.Consulting (2019), it is estimated that around 30% of globally traded Nickel-metal-hydride battery (NMHB) and Nickel-cadmium battery (NiCdB) cells and cases are used in consumer electronics and thus the ICT sector.

The NMHB and NiCdB covered by the HS code are only used in mobile phones according to World Customs Organization (2021). Cost-to-mass ratios of the different battery cells are used to identify the trade amounts and costs of LIB cells and cases. These ratios are calculated based on the energy densities reported by Wong and Chan (2012) (i.e. LIBs: 0.16kWh/kg, PbAcBs: 0.035kWh/kg, NMHB: 0.07kWh/kg, NiCdB: 0.04 kWh/kg) and the cost-to-energy ratios reported by Mongird et al. (2019) (i.e. LIB: 271$/kWh, PbAcBs: 260$/kWh), by Pollet et al. (2014) (i.e. NMHB: 600$/kWh), by Battery University (2021) (i.e. NiCdB: 400$/kWh). Following BloombergNEF (2020), it is assumed that the prices of battery packs are 70% of the prices of battery cells. The resulting cost-to-mass ratios are 6 $/kg for PbAcB cells and cases, 11 $/kg for NiCdB cells and cases, 29 $/kg for NMHB cells and cases as well as 30 $/kg for LIB cells and cases. Based on Yanamandra et al. (2022), the following market shares are estimated for the batteries: 29% for LIBs, 29% for PbAcBs, 21% for NMHBs, 20% for NiCdBs and 1% for other batteries. Thus, the following three requirements are considered: (i) all trades with a cost-to-mass ratio below or equal to 6$/kg are assumed to be 60% PbAcB cells and cases, 40% NiCdB cells and cases or modules, (ii) all trade with a cost-to-mass ratio between 6 and 30$/kg are assumed to be 29% LIB cells and cases, 29% PbAcB cells, 21% NMHB cells and cases and 20% NiCdB cells and cases and (iii) all trades with a cost-to-mass ratio above or equal to 30$/kg are assumed to be 58% LIB cells and cases and 42% NMHB and other battery cells and cases.

**Safety glass covered by the HS codes 700711 and 700721:**

Based on Grand View Research (2018a) and OEC (2020), it is estimated that 90% of the safety glass of vehicles, ships and aircraft is used in vehicles.

**Solar glass covered by the HS codes 700719 and 700729:**

According to Grand View Research (2018a) and Nikhil and Eswara (2022), the tempered glass market size is around $17 billion excluding the automotive sector. According to (Ayushi and Eswara 2019), the solar glass market size is $4.5 billion. Thus, around 26% of the tempered glass market is covered by solar glass.

**Glass fibers covered by the HS codes 701911, 701912 and 701919:**

According to U.S. Department of Energy (2017), 4% of the globally produced glass fibers are used in wind turbines.

**SD and SIM cards covered by the HS codes 852351 and 852352:**

Following the explanations of the HS code provided by World Customs Organization (2021), it is assumed that 50% of the SD and SIM cards covered by the HS codes are used in the mobile phones, laptops, computers and televisions, while the other 50% are used in cameras, data collection terminals, video game consoles etc.

**Monitor and TV equipment covered by the HS code 852990:**

Based on export trade values from UN Comtrade (United Nations 2016), it is estimated that 50% of the hardware equipment covered by the HS code 852990 is used in TVs and monitors.

**Aluminium wire covered by the HS codes 760521 and 760529:**

Based on Reports and Data (2020b) and Grand View Research (2019), it is estimated that 15% of the globally traded Al wires are used in the mobility sector.

**Permanent magnets covered by the HS code 850511:**

Based on Grand View Research (2020c), it is estimated that 22% of the globally traded permanent magnets are used in the mobility sector and 10% of the globally traded permanent magnets are used in the energy sector. Based on Grand View Research (2020c), it is estimated that 27% of the globally traded permanent magnets are used in the ICT sector.

**Aluminium foil covered by the HS code 760719:**

Based on Grand View Research (2021c), the authors best guess is that 6% of the aluminium foils covered by the HS code 760719 are used in LIB cells of vehicles.

Based on Grand View Research (2021c), the authors best guess is that 0.5% of the aluminium foils covered by the HS code 760719 are used in cells for stationary LIBs.

Based on Grand View Research (2021c), the authors best guess is that 1% of the aluminium foils covered by the HS code 760719 are part of LIB cells used in the ICT sector.

**Aluminium plate covered by the HS codes 760612 and 760692:**

Following Khoday (2019), OECD (2010) and Reports and Data (2020a), it is estimated that 18% of the aluminium plates that are covered by the HS codes 760612 and 760692 are used in the mobility sector.

Considering the information given by Reports and Data (2020a) and due to missing more detailed information about the aluminium plate use in the energy sector, the authors best guess is that 1% of the globally traded aluminium plates are used in the energy sector.

Following UC Rusal (2014), the authors best guess is that 5% of the globally traded aluminium plates are used in the ICT sector. Here, it is assumed that the part of the aluminium plates used for consumer goods and electrical engineering categories described by the source belong to the ICT sector.

**Niobium alloy covered by the HS code 720293:**

Following Mordor Intelligence (2022), 30% of the Niobium globally traded is used in the mobility sector.

**Vanadium alloy covered by the HS code 720292:**

Following Proactive (2022), it is estimated that 86% of the Vanadium alloy globally traded are used in the steel making. Following Grand View Research (2020d), it is estimated that 35% of the steel is used in the mobility sector. Thus, it is estimated that around 30% of the globally traded vanadium alloys are used in the mobility sector.

Following Reisman (2011), it is estimated that 7% of the steel shipments are used in the energy sector. Thus, around 6% of the globally traded vanadium alloys are used in the energy sector.

**Antimony powder covered by the HS code 811010 and antimony oxides covered by the HS code 282580:**

Following Jaiswal (2023b) (graphic address: https://mrfbucket.s3.amazonaws.com/uploads/infographics/Antimony\_Market.png), it is estimated that 30% of the globally traded antimony is used in the mobility sector and 15% of the globally traded antimony powder is used in the ICT sector.

Following Awe (2013), 19% of the globally traded antimony powder is used in PbAcBs and 9% is used in glass. Following Grand View Research (2018e), it is assumed that 33% of globally produced PbAcBs are used as stationary batteries. As mentioned above, around 26% of the tempered glass market is covered by solar glass. Thus, around 9% of the globally traded antimony powder is used in the energy sector.

**Aluminium unwrought covered by the HS code 760110 and 760120, aluminium oxide covered by the HS code 281820 and aluminium waste & scrap covered by the HS code 760200:**

Following Sauvage (2019) and Khoday (2019), it is estimated that 26% of the globally traded aluminium is used in the mobility sector and 14% of the globally traded aluminium is used in the energy sector.

Following UC Rusal (2014), the authors best guess is that 5% of the globally traded aluminium is used in the ICT sector. Here, it is assumed that the part of the aluminium used for consumer goods and electrical engineering categories described by the source belongs to the ICT sector.

**Barytes covered by the HS code 251110:**

Following European Commission (2020) and The Barytes Association (2023), the authors best guess is that 5% of the globally traded barytes are used in the mobility sector and 1% of the globally traded barytes are used in the ICT sector.

**Beryllium covered by the HS code 811212 and beryllium waste & scrap covered by the HS code 811213:**

Following Grand View Research (2016a), it is estimated that 10% of the globally traded Beryllium is used in the mobility sector and 10% of the globally traded Beryllium is used in the energy sector.

Following Grand View Research (2016a), it is estimated that 20% of the globally traded Beryllium is used in the ICT sector.

**Borates covered by the HS codes 284011 and 284019 and boric acid covered by the HS code 281000:**

Following Rajak et al. (2021) and Powoe et al. (2021), it is estimated that 12% of the globally traded Borates are used in the mobility sector and it is assumed that additionally 6% of globally traded Borates are used in automotive fluids. Thereby, 26% of globally traded glass is used in the mobility sector and 48% of globally traded borates are used in glass.

Following Rajak et al. (2021) and Powoe et al. (2021), 48% of produced borates are used in the glass industry and 15% of the produced glass fibers are used in the energy sector. As only small amounts of Borates are used for semiconductors and due to further missing data, the authors best guess is that around 1% of globally traded borates are used in semiconductors and glass of solar panels.

Following Rajak et al. (2021) and Powoe et al. (2021), it is estimated that 4% of the globally traded Borates are used in the ICT sector (48% is used in glass and 18% of this 48% is used in consumer goods (assumed that half of the consumer goods belong to the ICT sector)).

**Cobalt powder covered by the HS code 810520, cobalt intermediates covered by the HS codes 810520, 750110 and 750120 and cobalt waste & scrap covered by the HS code 810530**

Cost-to-mass ratios of Co powder and mattes are used to identify the trade amounts and costs of Co powder. These ratios are defined based on the average market price of cobalt metal (i.e. 26$/kg on the 29. July 2019 according to London Metal Exchange (2021) and Trading Economics (2021)) and based on the average market price of Co mattes (i.e. 11$/kg according to Baars et al. (2021) and the European Commission (2020)). Thus, regarding the content of the HS code 810520, the following three requirements are considered: (i) all trades with a cost-to-mass ration below or equal to 11$/kg are assumed to be Co mattes, (ii) following Baars et al. (2021), all trades with a cost-to-mass ratio between 11 and 26$/kg are assumed to be 50% Co mattes and 50% Co powder and (iii) all trades with a cost-to-mass ratio above or equal to 26$/kg are assumed to be cobalt powder. Cobalt mattes are considered together with the nickel mattes (HS code 750110) and nickel-cobalt sulfides (HS code 750120) as cobalt intermediates.

The share of cobalt used in the mobility sector is estimated with 28% based on Al Barazi et al. (2017) (i.e. 42%\*60% of cobalt used in traction batteries, 5%\*22% of cobalt used in magnets in vehicles and 4%\*50% used in fluids of vehicles).

The share of cobalt used in the energy sector is estimated with 2.6% based on Al Barazi et al. (2017) (i.e. 42%\*5% of cobalt used in energy storage batteries and 5%\*10% of cobalt used in magnets of energy applications).

The share of cobalt used in the ICT sector is estimated with 3% based on Al Barazi et al. (2017) (i.e. 42%\*5% of cobalt used in batteries of electronics in the ICT sector and 5%\*27% of cobalt used in magnets of electronics in the ICT sector).

**Fluorocarbons covered by the HS codes 290331 and 290339 and hydrogen fluoride covered by the HS code 281111:**

Following Grand View Research (2018b), it is estimated that 15% of the globally traded fluorocabons are used in the mobility sector (mobile air conditioning). Following Genuino et al. (2012) and Grand View Research (2018b), it is estimated that 9% of the globally traded hydrogen fluoride are used in the mobility sector (i.e. 60% of the hydrogen fluoride is used to produce fluorocarbons and 15% of the fluorocarbons are used in the mobility sector).

Based on Mandaokar (2023), it is estimated that 10% of the globally traded hydrogen fluorides are used as nuclear fuel elements in the energy sector.

**Rare Earth Elements (REEs) covered by the HS code 280530:**

Following Grand View Research (2017), it is estimated that 27.5% of the globally traded REEs are used in the mobility sector (i.e. 25%\*22% of REEs in magnets of vehicles and 22%\*100% of REEs used in exhaust catalysts of vehicles) and 2.5% of the globally traded REEs are used in the energy sector (i.e. 25% of REEs are used in permanent magnets and 10% of these magnets are used in the energy sector).

Following Grand View Research (2017), it is estimated that 7% of the globally traded REEs are used in the ICT sector (i.e. 25%\*27% of REEs in permanent magnets used in the ICT sector).

**Lithium covered by the HS codes 283691 and 282520:**

Following Grand View Research (2020a), it is estimated that 45% of the globally traded lithium is used in the mobility sector, 5.8% of the globally traded lithium is used in the energy sector (i.e. 5% in the grid storage and 20%\*4% in glass fibers) and 45% of the globally traded lithium is used in the ICT sector.

**Magnesium powder covered by the HS code 810430, magnesium unwrought covered by the HS codes 810411 and 810419 and magnesium waste & scrap covered by the HS code 810420**

Following Mordor Intelligence (2018), it is estimated that 35% of the globally traded magnesium is used in the mobility sector, the authors best guess is that magnesium used in energy products has a share of 1% and it is estimated that 10% of the globally traded magnesium powder is used in the ICT sector.

**Natural graphite covered by the HS codes 250410 and 250490:**

Following Levich (2018), it is estimated that 20% of the globally traded natural graphite is used in the mobility sector (33% used in batteries and 60% of these batteries used in the mobility sector), 1.65% of the globally traded natural graphite is used in the energy sector (33% used in batteries and 5% of these batteries used in the energy sector) and 2% of the globally traded natural graphite is used in the ICT sector (33% used in batteries and 5% of these batteries used in the ICT sector).

**Natural rubber covered by the HS codes 400110, 400122 and 400129:**

Following Blengini et al. (2017), it is estimated that 65% of the globally traded natural rubber is used in chassis (tires) applied in the mobility sector.

**Gallium, germanium, hafnium, indium, niobium, rhenium and vanadium powder covered by the HS code 811292:**

Cost-to-mass ratios and ratios between the production amounts for the powder of the different metals are used to identify their trade amounts and costs. As shown in Table S3, the seven metals are clustered into six different price categories considering the prices of each metal reported in the United States Geological Survey (USGS 2020). The share of the individual metals in each of the categories is determined based on the ratios between production amounts in each category. The following ratios are thus considered:

* Ratio of vanadium production to niobium and vanadium production (99.9%)
* Ratio of vanadium production to indium, niobium and vanadium production (99%)
* Ratio of indium production to indium, niobium and vanadium production (0.9%)
* Ratio of indium production to gallium and indium production (75%)
* Ratio of gallium production to gallium and hafnium production (91%)
* Ratio of hafnium production to rhenium and hafnium production (35%)
* Ratio of rhenium production to germanium and rhenium production (30%)

The shares in each of the price categories are described in Table S1.

Table S1: Shares of gallium, hafnium, indium, niobium, rhenium, germanium and vanadium amounts in different price categories estimated based on price and annual production data from the United States Geological Survey (USGS 2020)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Metals | Prices ($/kg) | Price categories | Annual production amount (in tons) | Shares in each price category |
| Gallium | 596 | 3. and 4. category | 327 | 25% and 91% |
| Hafnium | 750 | 4. and 5. category | 32 | 9% and 35% |
| Indium | 395 | 2. and 3. category | 960 | 0.9% and 75% |
| Niobium | 21 | 1. and 2. category | 67.7 | 0.1% and 0.1% |
| Rhenium | 1'030 | 5. and 6. category | 59.3 | 65% and 30% |
| Germanium | 1'046 | 6. category | 140 | 70% |
| Vanadium | 6.7 | 1. and 2. category | 105'000 | 99.9% and 99% |

The following requirements are then considered for the trade data covered by the HS code 811292. First, all trades with a cost-to-mass ratio below 6.7 $/kg are assumed to be 99.9% of vanadium trades and 0.1% of niobium trades. Second, all trades with a cost-to-mass ratio between 6.7 $/kg and 395 $/kg are assumed to be 99% of vanadium trades, 0.9% of indium trades and 0.1% of niobium trades. Third, all trades with a cost-to-mass ratio between 395 $/kg and 596 $/kg are assumed to be 75% of indium trades and 25% of gallium trades. Fourth, all trades with a cost-to-mass ratio between 596 $/kg and 750 $/kg are assumed to be 91% of gallium trades and 9% of hafnium trades. Fifth, all trades with a cost-to-mass ratio between 750 $/kg and 1030 $/kg are assumed to be 35% of hafnium trades and 65% of rhenium trades. Sixth, all trades with a cost-to-mass ratio above 1046 $/kg are assumed to be 70% of germanium trades and 30% of rhenium trades.

Following Mordor Intelligence (2022), 30% of the niobium globally traded is used in the mobility sector.

According to Proactive (2022), 5% of globally traded vanadium powder is used in batteries and 86% is used in steel making. According to Tsiropoulos et al. (2018) and U.S. Department of Energy (2020), 60% of the batteries are used in the mobility sector. Following Grand View Research (2020d), it is estimated that 35%% of steel are used in the mobility sector. Thus, it is estimated that around 33% of the globally traded vanadium is used in the mobility sector.

Based on Grand View Research (2021d), it is estimated that 15% of the globally traded gallium nitride semiconductor devices are used in the energy sector. According to Persistent Market Research (2022), 35% of the globally traded gallium is used in semiconductors. Thus, it is estimated that around 5% of the globally traded gallium is used in semiconductors applied in the energy sector.

According to Trento (2023), 13% of the globally produced Hafnium is used in nuclear power rods within the energy sector.

Following Grand View Research (2015), it is estimated that 10% of the globally traded indium powder is used in semiconductors. Following KBV Research (2022), it is assumed that 6% of these semiconductors are used in the energy sector (assuming a use of 50% in the industrial segment and 50% in the energy & power sector).

According to Proactive (2022), 5% of the globally traded vanadium is used in energy storage equipment and 86% in the steel making. Following Reisman (2011), it is estimated that 7% of the steel shipments are used in the energy sector. Thus, around 11% of the globally traded vanadium is used in the energy sector.

Following statista (2022), around 25% of the traded gallium in the EU is used in LED screens. It is assumed that this share is equal to the global application share.

Following ETF.com (2013), it is estimated that 56% of the globally traded indium is used in flat panel displays.

According to Proactive (2022), 5% of vanadium is used in batteries and, according to Tsiropoulos et al. (2018), 5% of the batteries are used in the ICT sector. Thus, it is estimated that around 0.25% of the globally traded vanadium is used in the ICT sector.

**Platinum group metals (PGMs) covered by the HS codes 711011 and 711041:**

Following Government of Canada (2023) and Grand View Research (2021b), it is estimated that 61% of the globally traded PGMs are used in the mobility sector and 7% of the globally traded PGMs are used in the ICT sector.

**Phosphoric acid covered by the HS code 280920:**

Following Hamblen (2019) and Grand View Research (2018d), it is estimated that 2% of the globally traded phosphoric acids are used in the ICT sector. (i.e. $827 million market of phophoric acid used in electronics in 2019 by a global phosphoric acid market size of 45.85 billion in 2019)

**Scandium covered by the HS codes 280530 and 284690:**

Cost-to-mass ratios of scandium and yttrium are used to identify the trade amounts and costs of scandium. The United States Geological Survey (USGS 2020) reports a price of 340$/kg for scandium alloys, 3'800$/kg for scandium compounds and 34$/kg for yttrium. Regarding the content of the HS code 280530, the following requirements are considered: (i) all trades with a cost-to-mass ratio below 34 $/kg are assumed to be yttrium trades, (ii) all trades with a cost-to-mass ratio between 34 $/kg and 340 $/kg are assumed to be 50% of Yttrium trades and 50% of Scandium trades and (iii) all trades with a cost-to-mass ratio above 340 $/kg are assumed to be Scandium trades. Regarding the content of the HS code 284690, the following requirements are considered: (i) all trades with a cost-to-mass ratio below 34 $/kg are assumed to be yttrium trades, (ii) all trades with a cost-to-mass ratio between 34 $/kg and 3800 $/kg are assumed to be 50% of yttrium trades and 50% of scandium trades and (iii) all trades with a cost-to-mass ratio above 3800 $/kg are assumed to be scandium trades.

Following Kaiser Research Online (2023), it is estimated that around 21% of the globally traded Scandium is used in the mobility sector (considered categories: Auto Skins, Auto Wheels, Auto U-Body, Auto Impact), the authors best guess is that 1% of scandium are used in the energy sector and it is estimated that around 5% of the globally traded scandium is used in the ICT sector (considered categories: Phone cases).

**Silicon metal covered by the HS codes 280461 and 280469:**

Following Technavio (2017), it is estimated that 8% of the globally traded silicon metal is used in the mobility sector, 6.5% of the globally traded silicon metal is used in the energy sector and 16% of the globally traded silicon metal is used in the ICT sector.

**Tantalum covered by the HS code 810320 and tantalum waste & scrap covered by the HS code 810330**

Following Mordor Intelligence (2017) and Grand View Research (2021b), it is estimated that 4% of the globally traded tantalum is used in the mobility sector. Here, it is assumed that 40% of globally traded tantalum is used in capacitors and 10% of the capacitors is used in the mobility sector.

Following Mordor Intelligence (2017) and Grand View Research (2021b), it is estimated that 14% of the globally traded tantalum is used in the ICT sector. Here, it is assumed that 40% of globally traded Tantalum is used in capacitors and 35% of the capacitors is used in the ICT sector

**Titanium covered by the HS code 810820 and titanium waste & scrap covered by the HS code 810830**

Following Heydemann et al. (2020), it is estimated that 6% of the globally traded titanium is used in form of high performance alloys in the mobility sector.

Following International Titanium Association (2019), it is estimated that 5% of the globally traded titanium is used in the energy sector (considering the sector called "power generation" in the source).

Following Heydemann et al. (2020), the authors best guess is that 1% of the globally traded titanium powder is used in the ICT sector (excluding the titanium oxide used in electronics of the ICT sector).

**Titanium oxide covered by the HS code 282300**

Following Heydemann et al. (2020), it is estimated that 6% of the globally traded titanium is used in form of high performance alloys in the mobility sector. Following Grand View Research (2016c), it is estimated that around 30% of the titanium oxide is used in electronics and following Grand View Research (2021b), 10% of these electronics are used in the mobility sector.

**Vanadium oxide covered by the HS code 282530:**

Following the explanations regarding the content of the HS code 811292 covering vanadium powder, it is estimated that around 33% of the globally traded vanadium is used in the mobility sector.

**Tungsten covered by the HS codes 810110 and 810194:**

Following Nagrale (2023), 15% of the globally traded tungsten is used in the ICT sector.

**Strontium covered by the HS code 281640:**

Following Jaiswal (2023a), it is estimated that 20% of the globally traded strontium oxide is used in the ICT sector.

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