To whom this may concern

Concerning: indium as critical and strategic raw material 26 May 2023

IMAT e.V. (**I**nnovative **MAT**erials for sustainable high-tech electronics, photonics and related industries) is a German vertical association comprised of a network of companies and research institutions in the context of **III-V semiconductors**. The members cover all stages of the value chain from the **wafer** through the **chip**, up to the module and its applications. More information on https://imat-ev.eu/

Hereby IMAT's point of view on the disappearance of indium from the CRM list.

1. Use of indium and its disappearance from the CRM list

Indium phosphide (InP) is an important III-V semiconductor for data communication, IR sensing & detection, 6G and satellite communication (see annex I for a more detailed description of InP uses). Although only ~200 kg indium phosphide is needed in Europe for semiconductors, it does not make InP less crucial in the semiconductor world.

Indium has been on the CRM list since the first list was published in 2011. Unfortunately, it now disappeared from the fifth list as published in 2023 based on misleading information in the SCRREEN factsheet on indium.

2. Indium should remain a critical raw material

Based on our analysis of the new SCRREEN indium fact sheet we would like to comment as follows:

- The use of indium metal is linked to the use of several indium compounds – e.g. indium tin oxide (ITO) and indium phosphide (InP). The applications of those indium compounds are described in annex I and II.
- The various downstream user sectors require different qualities. For semiconductors the indium metal obtained as a by-product from the extraction of zinc is not useful. Even the so-called "refined material" mentioned in the fact sheet (which means 4N grade) is not good enough for the needs in electronic devices, which **need the 6N high-grade = 99,9999% purity**.
- This **high-grade indium is produced outside of the EU only**. In the fact sheet is mentioned *"…Germany's small production which consisted into upgrading 4N indium (99.99 In) to very high purity indium (up to 7N) (PPM Pure Metals) was not included in the EU primary production. …"* but meanwhile this company was taken over by a Chinese one and due to political constraints, the production of ultra-pure metals was relocated to China. This causes a **100% dependency on non-EU-suppliers** for high-grade indium.
- Furthermore, in the fact sheet it is mentioned that *"…In Germany, Saxony Minerals and Exploration AG is working at the Pöhla deposit in Saxony, Germany with the aim of starting tungsten, tin, indium and fluorite production. According to the company, pilot scale production*

has started in late 2017 (Lauri, L. et. al., 2018)." With respect to primary indium this is not the case today.

- In the fact sheet the project team reports *"…As many countries around the world consider indium as a critical metal, risk assessment is significant. It is known that when the upstream industry is greatly affected by foreign countries, the entire industry chain will be affected to varying degrees."* Meaning, the **availability of high-grade indium for Europe might be jeopardized by the worldwide demand.**

3. Indium should become a 'strategic' raw material

As can be found in the SCRREEN paper for indium "Given its use in photovoltaic cells and in batteries, indium can play a role in enabling low-carbon energy solutions in the EU economy, contributing to achieve the objectives of the "European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy. The main demand drivers from 2022 onwards will be thermal interface materials, alloys, and LED."

Considering the above and the socio-economic importance of these applications, it is clear that **indium has a "strategic" value for Europe in areas like e.g. communication, space and defense.**

4. How to sustain EU's autonomy for indium supply?

IMAT believes that if indium is considered also a strategic substance, the EU's autonomy for indium supply can be sustained in the coming years by working on:

1. EU recycling
2. EU supply
3. EU stockpiling

5. Conclusion

Removing indium from the CRM list would leave the EU in a very vulnerable position considering the further communication, digitalization, Clean Energy and Green Deal objectives it is aiming to reach as **100% of the high-grade indium, needed for semiconductor applications, is coming from outside the EU.**

Indium should therefore remain critical, but also become **a strategic raw material** and we hope to see this reflected in the final **Chips and CRM Act** to help ensure a continued availability of chips on the EU market.

Kind regards

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ANNEX I – use of indium phosphide

Indium phosphide (**InP**) is an important III-V semiconductor on the EU market, used as the basis for optoelectronic components, high speed electronics and photovoltaics. InP has major recognized technical advantages for several applications and high frequency devices (RF, THz). It is the only technology that can provide the performance needed at frequencies above> 100GHz. InP will be key for future high-speed communication generations as targeted by the European Commission.

Furthermore, InP is indispensable for the fabrication of high-power quantum cascade lasers (QCL). Such devices find their application in systems protecting military and civilian aircrafts from infrared homing missiles (DIRCM, Directed Infrared Counter Measures). For this reason, QC- lasers are not commercially available on the market.

Novel medical diagnosis systems and stand-off detection of dangerous materials are also based on these types of lasers.

Currently the InP small diameter substrates (2”-4”) are state of the art and the global supply is low in terms of availability and quality. But serious efforts are made to build a European supply chain from the substrates up to devices.

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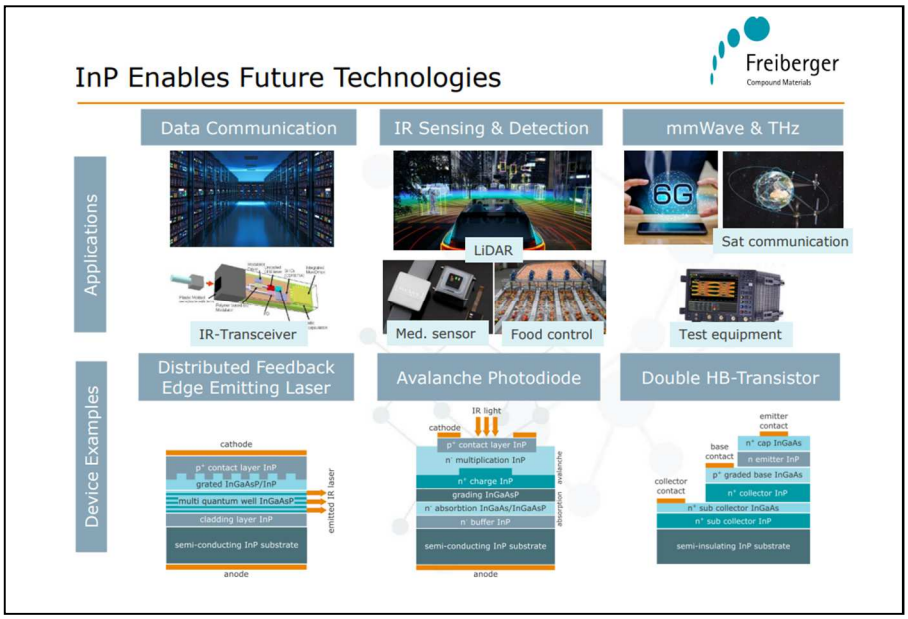

ANNEX II – use of indium tin oxide

Indium tin oxide (ITO) or tin-doped indium oxide is a mixture of indium oxide and tin oxide in which the tin component can contribute up to one-fifth of the material composition. Indium tin oxide is a transparent (see-through) material with electrical conductivity. Indium tin oxide is applied mainly as a film to create transparent conductive coatings in the opto-electronic industry, for example to protect image sensors of digital cameras, or displays based on LED technology (*LED = light emitting diode*). It is used in heated defrosting coatings for the cockpit windows of the Airbus. Another interesting new application is the usage of indium tin oxide in a new generation of solar cells.

(https://nanopartikel.info/en/knowledge/materials/indium-tin-oxide-ito/#:~:text=Indium%20tin%20oxide%20is%20applied,LED%20%3D%20light%20emitting%20diode).