

Position paper of the semiconductor industry on the possibilities of recovering gallium through recycling

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Gallium is an indispensable critical raw material for high-performance microelectronic components used in areas such as high-frequency and optical communication, industrial lasers, advanced magnetic and optical sensors, energy-efficient power electronics, and also in the defense sector (e.g. radars). Gallium is currently predominantly sourced from China and is now subject to export restrictions. This often involves unacceptable usage restrictions, disclosure obligations, and the acceptance of Chinese law within the territory of the EU.

In addition to alternative sourcing options, recycling represents a promising option to reduce dependencies from non-EU countries.

Three cases must be distinguished here:

1. Recycling within during wafer manufacturing
2. Recycling from downstream industrial production facilities and
3. Recycling from end products at the end of their lifespan.

In case 1, this has been taking place for many years. In the production of GaAs wafers, there are large amounts of waste in the form of non-usable end pieces of the crystals and sawdust generated during the wafer production. These "wastes" are of high quality, minimally contaminated with other substances, and therefore ideally suited for recycling.

In case 2: For stability reasons, GaAs wafers must have a certain thickness for further processing. At the very end of the manufacturing process, they must be thinned down to roughly 1/5 of the original thickness through a grinding process to meet the desired technical specifications. Liquid waste is generated during this process, which also contains significant amounts of gallium and can be recycled. This is also carried out for cost reasons, primarily to save disposal costs. Thus, more than ¾ of the Ga is recycled during wafer and device production.

However, this considerable amount of recyclable gallium is not generated in the EU, but for the most part in chip factories in the USA and Taiwan. As this is hazardous waste, transportation across national borders is associated with considerable administrative hurdles (Basel Convention), which make it almost impossible to establish a stable circular economy. It would therefore be important to significantly simplify the administrative regulations, e.g. by declaring the material as a "recyclable material" and not as "waste".

In case 3, recycling is not feasible for technical and economic reasons. As the name "microelectronics" suggests, semiconductor chips are tiny, surrounded by protective housings made of plastic or ceramic, and integrated with a multitude of other components on a circuit board. Here, gallium is only present in minute traces and surrounded by a variety of other substances. Recovering relevant amounts of gallium from such a complex mixture is not always possible and currently not feasible in an economic way.

About IMAT e.V.:

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