15 June 2018

To Oeko-Instiute

Joint input to (RoHS 2, Pack 15) 1st Stakeholder Consultation – Questionnaire for Indium phosphide (CAS 22398-80-7; EC 244-959-5)

Introduction to signatories:

The **Institute for Photonic Integration** is a leading R&D center in the field of photonics. The work of the institute ranges from fundamental scientific research to the development of prototypes that are taken on to the product stage by industry. The Institute for Photonic Integration continues the research of the TU/e research school COBRA, and therefore possesses an extensive staff of researchers along with a large cleanroom (800 m^2) optimized for photonics R&D. The research school has been one of the world's leading proponents of photonics research for many years. Furthermore, there is intensive collaboration on photonics with the research groups of the University of Twente and Delft University of Technology. The institute covers three fields: photonics materials (III-V semiconductors), integrated circuits (photonic integrated circuits, PICs) and photonic systems.

PhotonDelta is the Dutch national platform organization for integrated photonics, consisting of companies operating in the value chain, research institutes and technology development organisations. One of the key partners of PhotonDelta is the open foundry SmartPhotonics. They producing photonic integration circuits on an Indium Phosphide (InP) platform. Furthermore, key device partners like Technobis, Lionix and Effect Photonics serving customers worldwide with InP based, PIC products. PhotonDelta is also the organization that is implementing the National Plan for integrated photonics as of January 1, 2019. We are currently also one of Europe's leading Digital Innovation Hubs, actively linking best-in-class research and development to best business practice. PhotonDelta is acting as the lead partner in the European Photonics Alliance. The European Photonics Alliance is focussing on inter-regional calls since inter-regional collaboration is not the focus of other photonics collaborations within Europe. We will tap into funding expertise from across the lead-regions to establish novel inter-regional funding strategies to help SME's.

EPIC is the industry association that promotes the sustainable development of 370 organizations working in the field of photonics in Europe. We foster a vibrant photonics ecosystem by maintaining a strong network and acting as a catalyst and facilitator for technological and commercial advancement. EPIC publishes market and technology reports, organizes technical workshops and B2B roundtables, supports EU funding proposals, advocacy and lobbying, education and training activities, standards and roadmaps, pavilions at exhibitions. www.epic-assoc.com

Please find herewith our inputs to the first stakeholder consultation concerning Indium Phosphide.

1. Applications in which indium phosphide is in use

a. Please provide information concerning products and applications in which the substance is in use.

Photonic integrated circuits and semiconductor lasers in the mid-IR are now widely deployed for high performance internet links. Indium Phosphide circuits offer the gold standard in circuit size, energy efficiency and performance for devices connecting fiber-optic cables to electronic equipment. There is no replacement semiconductor technology for such devices in telecommunications. InP replaced other solutions by enabling far more efficient communications systems and architectures.

2. Quantities and ranges in which indium phosphide is in use

a. Please detail in what applications your company/sector applies indium phosphide and give detail as to the annual amounts of use. If an exact volume cannot be specified, please provide a range of use (for example – 10-100 tonnes per annum).

The TU/e is a research organisation and uses of order hundred wafers per year which corresponds to significantly less than one boule per year, so this is significantly less than 1kg.

3. Potential emissions in the waste stream

a. Please provide information on how EEE applications containing indium phosphide are managed in the waste phase (with which waste is such EEE collected and what treatment routes are applied)?

The Indium Phosphide used at TU/e is disposed of in a controlled environment. Methods for recovering Indium Phosphide are known and can be developed for large quantities.

4. Substitution a. Please provide details as to the substitution of indium phosphide:

i. For which applications is substitution scientifically or technically not practicable or reliable and why.

There is no effective replacement for lasers operating in the mid-IR. Potential replacement technologies for electro-optic devices such as modulators and detectors do not satisfy performance requirements for increasingly stringent energy-efficiency requirements.

5. Socio economic impact of a possible restriction

Please provide information as to the socio-economic impacts if indium phosphide is to be restricted under RoHS. Please specify your answers in relation to specific applications in which the substances are used and/or in relation to the phase-in of specific alternatives in related application areas. Please refer in your answer to possible costs

Indium Phosphide photonic technologies underpin the modern internet. Sustained, equitable access requires performance increases without consuming additional energy. Indium Phosphide provides the route to sustained energy savings, and therefore the only credible route to widely available internet connectivity.

Indium Phosphide photonic technologies are well positioned to enable a new generation of safety products, 3-D sensors, structural health monitoring devices, and environmental monitoring devices which may be deployed in cars for collision-warning, buildings for collapse-prediction. Healthcare products from tissue imaging systems through to haptic sensing in instruments may have considerable added savings through preventative procedures. These potential products benefit from InP micro-chip engines, and are being pioneered by tens of European innovators across many sectors. This leads to the miniaturisation of many electrical appliances, reducing the use of other undesirable materials associated with cabling, packaging, and assembly. These innovations are accelerated with the active support of European research framework programs such as Horizon 2020 and programs in the US and Asia. Europe has a lead in this field. TU/e operates an open access facility on behalf of many innovative European businesses to provide experimental Proof of Concept PICs. Prototypes are developed in

many sectors reaching from security systems through to healthcare tools, and sensing systems. Information on the potential societal impact of photonic systems has been documented by the Photonics21 public private partnership with the European Commission.
https://www.photonics21.org/download/ppp-services/photonics-downloads/Photonics21-Vision-Paper-Final.pdf

The role Indium Phosphide technologies in photonics is captured in the JePPIX roadmap at www.JePPIX.eu/vision

We would be pleased to contribute further to the discussions on the projected socio-economic impact of Indium Phosphide.

Regards,

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