Novel materials and nano-risk in semiconductor industry

Panel Statement

The NanoStreeM project held a workshop for the industrial stakeholder community as a satellite event at Semicon Europa, Munich on 14 Nov 2018. The workshop ended with a panel discussion between Dr. Michael Jank, Fraunhofer IISB; Dr. Dimiter Prodanov, Imec; and Mr. David Carlander, Nanotechnology Industry Association. The panelists discussed three interrelated questions:

- How do future materials fit into the current risk assessment framework?

- What competences do we need to evaluate emerging risks?

- How can the risk be communicated along the supply chain?

How do future materials fit into the current risk assessment framework?

D Carlander expressed the view that the existing regulatory risk assessment approach employed by REACH allows for integration of novel materials deployed by the semiconductor R&D. It is also very likely that novel advanced nanomaterials or articles patterned at the nanoscale can fit into the present framework. D. Prodanov pointed out that R&D grade materials will most likely fall under the tonnage requirements set out in REACH, which can present a problem for occupational risk assessment as demonstrated in NanoStreeM.

M. Jank summarized his presentation by the observation that employing nano features does not necessarily mean the direct use of "free" engineered nanomaterials. The literature survey employed in NanoStreeM further indicates that most likely novel materials will morph into existing planar Si/Ge processing technology, which avoids handling of "free" nanomaterials. Therefore, top-down production of nano-functionalized materials and device approaches will not add additional hazards only because it is "nano".

D Prodanov pointed out that metrics for hazard at the nano-level most likely will remain number or area based for inhalation hazards. The case of dissolution however, as pointed out by M Jank, for example of Ag, exposes the ion toxicity, which is related to the mass. Therefore, the route of exposure will eventually determine the most appropriate metrics. In the occupational setting of the semiconductor processing this is clearly the inhalation hazard during maintenance. This compounds with other hazards, for example the outgassing of wafers as demonstrated by Salim El Kazzi.

What competences do we need to evaluate emerging risks?

The panelists agreed that competence development regarding nanosafety is very important for the safety professionals. A challenge in the filed is even the identification of the fact that certain

products contain nano-forms. This bring about development of dedicated training packages, for example the ones developed in NanoStreeM.

D Carlander pointed out that the findings of several projects, including NanoStreeM, demonstrate necessity for specific service provision facilitating occupational risk assessment by means of monitoring of nanomaterial emissions. Challenges there are the lack of harmonized measurement protocols and lack of service suppliers with sector-specific experience.

How can the risk be communicated along the supply chain?

The panelists agreed that communication along the supply chain is difficult and will remain an issue in the future. The regulatory options for example of specific labels or modification of CAS numbers for nanoforms can be considered. On the other hand, labeling can present a risk for miscommunication with the general public if the social dialogue about nanotechnology is not effective.

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The research and development (R&D) approach in semiconductor industry represents an example of Safe-by-Design approach that may have some generic properties transferable to other industries. Furthermore, the existing European regulatory risk assessment approach, represented by the REACH Regulation 1907/2006, the CLP Regulation 1272/2008 and the Chemical Agents Directive 98/24EC in combination with the ISO Standard ISO/TS 12901-2:2014, can be also used suitably also for the novel materials deployed by the semiconductor R&D. However, more attention is needed in assessing possible environmental hazards at the end-of-life of different products.

Metrics for establishing for hazard at the nano-level most likely will remain number or area based for inhalation hazards. However, the route of exposure will eventually determine the most appropriate metrics.

Competence development regarding nanosafety is very important for the safety professionals. A challenge in the field is even the identification of the fact that certain products contain nano-forms. This bring about development of dedicated training packages, for example the ones developed in NanoStreeM.

Communication along the supply chain is difficult and will remain an issue in the future. The regulatory options, for example, of specific labels or modification of CAS numbers for nanoforms can be considered. On the other hand, labeling can present a risk for miscommunication with the general public if the social dialogue about nanotechnology is not effective.