NanoStreeM Newsletter

In this issue

- Governance of emerging nano-risk in semiconductor industry
- NanoStreeM Safety Roadmap completed
- Key Findings in Workpackage 2
- Premed presenting at NanOEH congress
- NanoStreeM visiting the STMiroelectronics site in Malta
- NanoStreeM at EuroNanoForum 2017

Editorial by Dimiter Prodanov

Dear readers,

It is a pleasure to present you the NanoStreeM Newsletter, issues 3 and 4. The project has already gathered a substantial understanding into how nanomaterials are used in the semiconductor industry. We have also identified suitable sampling techniques to estimate nanoparticle emissions in the air and waste waters. In addition we would like to draw to your attention the workshop that we organize with calIBRAte with the support of the Royal Academy for Arts and Sciences. You are welcome to discuss with us the governance of nano-related risks in semiconductor industry on 26th April 2018, in Brussels!

NanoStreeM Newsletter
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NanoStreeM stakeholder event
by NanoStreeM

The workshop Governance of emerging nano-risk in semiconductor industry will address the key topic of risk governance for nanomaterials within the semiconductor industry. The event will bring together regulators, policy makers, the growing risk governance community for nanomaterials as well as industrial producers and end-user companies. The meeting will present how and where nanomaterials are used in the semiconductor industry based on the findings of the NanoStreeM project. The project caLIBRAte will present nanomaterials risk governance frameworks which could be applied within the semiconductor industry. The workshop will conclude with a panel discussion on the steps necessary to further enable use of nanomaterials throughout the industry and appropriately govern the emergent risks. The meeting outcome will identify the challenges and regulatory issues in semiconductor industry and how risk governance tools for nanomaterials can support effective business operation.

Risk governance tools for nanomaterials

Engineered Nanomaterials are used in a variety of applications: from cosmetics and paints, to sportswear and semiconductor chips. While for chemicals there are established regulatory frameworks dealing with the risk for the consumers, workers and the environment, this is not the case for nanomaterials. The reason is precisely the purpose for nanomaterial use – the properties of matter at the nanoscale change and become dependent on the particle size and shape. In order to mitigate the relative lack of information about such novel materials, the European Commission has launched the concept of safe-by-design, which is tested in a variety of ways in different funded projects. Semiconductor manufacturing employs top-down high precision approaches offering nanometer resolution of detail. This is achieved by following a rigorous approach to process quality and worker safety. This setting can be used as a natural test bed for the risk assessment approaches developed as manifestations of the safe-by-design concept. Identifying methodologies for risk assessment and governance of situations where risk could emerge from nanomaterial use is part of the work undergoing the H2020 project NanoStreeM. The H2020 project caLIBRAte addresses risk governance in nanomaterials throughout their life-cycle, creating a system of systems to align risk governance models for use across research and industry in the development of novel materials.

More information can be found on http://www.nanostreem.eu/events/governance-event/

NanoStreeM Safety Roadmap completed
by NanoStreeM

Workpackage 1 has completed the nanomaterial safety road map. The road map can be summarized as follows.

Throughout the years, the European semiconductor industry has maintained an excellent record in Environmental Health and Safety Management. As an industry that is always on the cutting edge of scientific discovery, it is predisposed to having to resolve novel Environmental Health and Safety topics. One such subject concerns comprehending the unique characteristics of nanomaterials in relation to worker health and environmental consequences. The industry is well represented in the NanoStreeM consortium.

In the view of the consortium partners, a holistic view of the nano-hazards and the associated process risk is critical for the successful pragmatic integration of nano-safety aspects in an overall risk management methodology for semiconductor manufacturing. Moreover, this is an implementation of the Safe-by-design principle in top-down nanotechnology.

The current REACH and CLP regulations in European Union do not facilitate communication of possible risks at the level of safety data sheets, as information regarding presence of nanomaterials is not indicated.

Processes investigated so-far within the project demonstrate that potential worker or environmental exposure to nanoparticles is very low. Experts working in the project have identified suitable tools to measure emissions of air-borne nanomaterials,
which are compatible with conditions present during semiconductor manufacturing.

In our view it is important to further grow EHS knowledge as how to identify the presence of nanoparticles in the workplace and how to minimize exposure to workers and the environment.

It is also important to promote standardization and validation of available risk assessment methodologies for nanomaterials. Based on the preformed analysis it is important to advance pragmatic risk assessment tools and solutions to aid in the mitigation of potential nanoparticle exposure in the workplace and the environment.

It is also important to develop dedicated training material both in an instructor lead and online format to cater for enhanced safety training in nanomaterials.

The full road map presentation can be downloaded from the link 1.

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Key Findings in Workpackage 2

by NanoStreeM

The findings in Workpackage 2 can be summarized as follows:

- Methodologies for exposure assessment are mainly based on tiered approaches
- No regulatory OELs addressing nanomaterials have been provided by the EU or by any national/international authority
- A waste water analysis protocol has been proposed and tested by the NanoStreeM consortium

Exposure assessment

Air sampling

- identified 38 devices for emission measurement
- advantages and limitation of every selected device identified
- Counters with internal background must be excluded, only condensation particle counters can be used
- Final choice for sampling and analysis should be done based on the study objectives

Water sampling

For water and waste water analysis, only the Dynamic Light Scattering (DLS) technique has been identified. It is easy to use. However, it provides an overall estimation of the size of particles but not their numbers or chemical composition. Therefore, a second tier approach, such as electron microscopy can be necessary for validation.

Measurement techniques

A tiered approach in the potential exposure assessment is a basis shared by most of the analyzed standards (see Figure). Differences can be noticed in the number of tiers or their organizations but the process is globally the same. The principle is to progress step by step, seeking if an exposure to nanomaterials can be excluded. If it is not the case, the standard leads to the next step. An important point is that generic standards propose a logical path to reach a conclusion on potential exposure. They propose also instruments, but generally more as a list of possible techniques or devices. The adequacy between the process and suitable equipment depends a lot from instrument availability and measurement experience. Thus, the equipment cost and experience in their use for potential exposure assessment stay a limitation for wider use of these methodologies out of the nanosafety expert community. This point is especially critical when the sought particles have uncommon properties like nanotubes or nanowires. Even if the framework given by standards applies, the sampling and analysis techniques require dedicated equipment and expert knowledge. Semiconductor industry can integrate the tiered approaches proposed by WP2. Specifics of clean rooms will influence more the choice of instruments to be used. The absence of background is a major advantage that facilitates and enhances the measurement sensibility. Devices will have to be chosen to benefit from this environment.

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Flow chart of the OECD approach for exposure assessment.

Premed presenting at NanOEH congress

by Dimiter Prodanov

Premed has conducted a survey among the industrial partners in NanoStreeM asking questions about health surveillance of their employees who may be in contact with nanomaterials at work. Premed is and External Occupational Health Service based in Leuven, Belgium. Premed, together with TNO, is responsible for the Health and Safety part of NanoStreeM. The service will formulate recommendations towards medical data collection and screening for adverse health effects of nanomaterials.

The approach of NanoStreeM towards occupational monitoring of nanomaterials was presented on the 8th International Symposium on Nanotechnology, Occupational and Environmental Health (NanOEH) by Dr. Eline Vandebroek. Dr. Vandebroek works as an Occupational physician since 2013 in Premed. Results indicate the need of focused epidemiological studies in exposed groups and the lack of in vitro and vivo studies to establish suitable biomarkers related to exposure.

Participating in the NanOEH-congress in Denmark was a great experience. In the first place it permitted me to exchange field experience regarding nanomaterials with other occupational health professionals from all over the world. Secondly, I was also introduced to the wide field of scientific studies (in vitro and in vivo experiments) that are done to better understand the possible health effects caused by nanomaterials. It’s clear to me that we need both, epidemiological and experimental studies, to broaden our knowledge and to come to a consensus regarding medical surveillance for nano-workers.

says Dr. Eline Vandebroek from Premed.

The conference was held on the island of Elsinore, Denmark. The main theme of the conference was "Closing the gaps in nanosafety". The aim of the NanOEH Conference 2017 was to provide a platform for presentation of the current knowledge on nanosafety in the working environment as well as in the general environment and of the current state of the art for strategies for exposure assessment, hazard evaluation and risk assessment.
NanoStreeM visiting the ST site in Malta

by DIMITER PRODANOV

Malta is the smallest member state of the European Union. Yet the island has a great cultural heritage and rich history. The location of the island in the middle of the Mediterranean has historically given it great strategic importance as a naval base, and a succession of powers, starting from the Phoenicians and Carthaginians, and finishing with the Knights Hospitaller, and the British have ruled the island.

By serendipity, the spring project meeting coincided with the EU presidency of the country. As part of the visit the project members visited the fabrication facility of the STMiroelectronics in Kirkop where they were demonstrated the operation of a completely automated packaging line for components. ST employs some 1 500 people in Malta, making it the largest private sector employer. It is also the country’s leading exporter.

Consortium members discussed the achieved progress and the upcoming activities in 2017 – 2018. The communication and dissemination strategy for the rest of the year was confirmed. This included participation in the EuroNanoForum 2017 in June and Semicon Europa in Nov.

NanoStreeM had a very successful project meeting in Malta! It was a great pleasure to experience the hospitality of the local Organizing Committee and to admire the rich history and culture of the island.

NanoStreeM presented at EuroNanoForum 2017

by NanoStreeM

The findings of Workpackage 1 have been presented in a poster at the EuroNanoForum 2017 in La Valletta, Malta. The conference was organized as scientific and innovation focal point of the Maltese EU presidency. The meeting had the objective to discuss how nanomaterials and nanotechnologies can strengthen competitiveness across all European industries. Dimiter Prodanov presented a poster summarizing the findings in WP1

- To compile an inventory of nanomaterials currently used / generated in semiconductor manufacturing or research environments.
- For identified nanomaterials, to map their trajectories in a typical semiconductor facility identifying hotspots for worker or environmental exposure.

We had the opportunity to interact with a variety of stakeholders, such as the Nanotechnology Industry Association, legal professionals, academics and policy makers from the European Commission and some member states.
The third consortium meeting in Kirkop, Malta, March 2017.