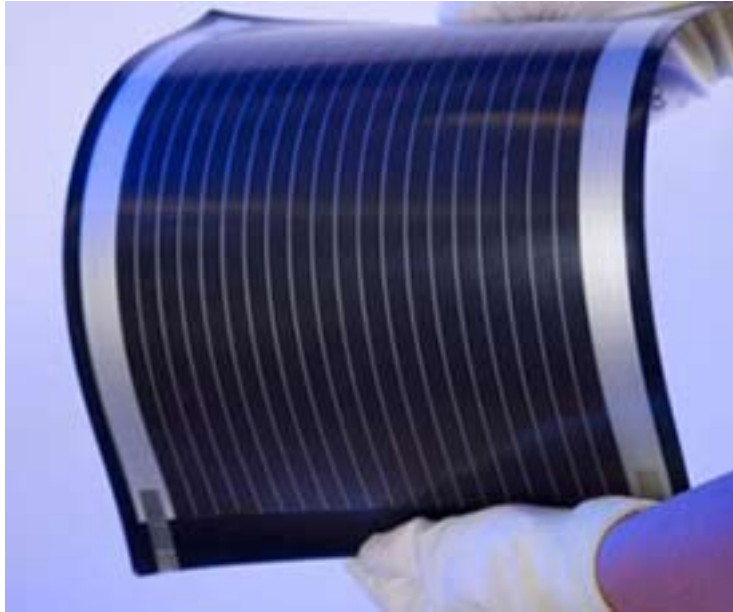


Dossier Nanotechnology



Flexible solar cell, developed by TNO together with Helianthos

At less than a hundred nanometers, we find ourselves in the realm of nanoparticles, a fascinating and highly promising world that is only just being discovered by man. This relative obscurity can trip us up in two ways. We could be so blinded by the possibilities that we fail to see the dangers or we could be so blinded by the dangers that we fail to exploit the opportunities. The challenge is to use nanotechnology safely and responsibly. TNO is investigating how.

What is nanotechnology?

Nanotechnology enables the precise and controlled building of new structures of less than 100 nanometers in size from atomic or molecular building blocks. This offers phenomenal possibilities to improve raw materials and products. The use of nanoparticles is one of the many topics within the nanotechnology realm. A virtually unlimited number of properties can be acquired through developing particles that contain a very specific composition, shape or charge. Like dirt-repellent or antimicrobial surfaces, extremely resistant materials or coatings that react to changing environments. While the new properties hold much promise, there is also some concern about possible health and environmental risks.

Products in the market

Hundreds of nanotechnology applications are already in the market: suntan lotions, coatings, cosmetics, cleansing agents and clothing are some examples. Around 140 nanotechnology consumer products are currently available in the Dutch market, a figure that is expected to increase in the coming years. Many new nanotechnology applications are still being developed in the R&D province.

Legislation and risk assessment

The more products containing nanoparticles that get into the market, the more the concern grows about possible risks. This is particularly the case for insoluble nanoparticles that cannot be naturally degraded, with the result that they accrue in organisms and the environment and may, as a consequence, be harmful to health. However, it is unlikely that consumers will be exposed to significant quantities of 'free' nanoparticles: the particles are 'enclosed' in paint, coatings, lotions or plastics. Employees involved in the production or processing of nanomaterials, however, may run such an exposure risk. Current legislation (the Occupational Health and Safety Act as well as REACH) make companies responsible and liable for introducing safe products and providing safe and healthy workplaces. But since almost all the nanomaterials we know were only developed very recently, a question mark remains over the adequacy of conventional methods of risk assessment.

The role of TNO

TNO is working with other scientific top institutes and consulting closely with industry and government towards sustainable product innovation in the field of nanomaterials with a focus on functionality and potential risks. Research into new functional properties and the toxicity of human exposure to nanoparticles helps companies in their development, production and application of sustainable nanomaterials.

The success of nanoparticles lies in the interaction of the particles with each other and their environment. By modifying the particles and setting them in a structure, this interaction can be enhanced and the behaviour of the particles adapted to different environments. TNO helps companies to both modify the particles and set them into a structure. For instance, connecting layers to improve barrier properties or generating new properties, like antifouling, hydrophilic/hydrophobic, connecting or barrier properties, that are coherent with the multidimensional structure.

TNO's expertise in the field of exposure assessment and respiratory toxicology is unparalleled. A key prevailing research area is the development of toxicological (screening) models to enable companies to be advised about nanoparticle selection at the earliest possible stage in the development process of a product. TNO also develops risk evaluation and control methods for the safe production and application of nanomaterials in the workplace.

Partners in the Netherlands

In 2008 TNO was closely involved in setting the strategic research agenda of the Netherlands Nano Initiative (NNI) and in the FES High Tech Systems & Materials programme application 2009, TNO led the 'Human Health Risks' programme in the field of nanomaterials.

Within KIR-nano (the knowledge and information point for nanotechnology risks) TNO works closely with the RIVM (national public health institute) on the topic of safety at work and nanotechnology. KIR-nano tasks include signalling new knowledge about the risks of nanotechnology, advising government and

informing government and professionals about possible risks. The knowledge and information point is a task assigned by three governmental ministries.

International partners

The Netherlands is an active participant in the OECD Working Party on Manufactured Nanomaterials (WPMN), helping to get international agreement on the requisite research input in the field of nanotechnology. TNO is involved in a number of steering groups in the area of exposure and nanomaterials testing. TNO also works with international companies (producers and downstream users).

EU-projects

FP6 NANOSH

Research within this project focuses on occupational exposure as well as the effects and interpretation of health risks related to the production and application of nanoparticles. Part of this work is concerned with establishing occupational exposure to air-borne nanoparticles in realistic scenarios. TNO's input is to perform and interpret workplace measurements and to set up a database from which 'good working practices' can be derived.

FP7 NANODEVICE

The aim of this project is to develop innovative concepts and methods to measure and characterise air-borne nanoparticles that are produced intentionally in the workplace, with the proviso that the new equipment is both portable and easy to use. Such a device does not yet exist.

TNO is leading the 'Exposure assessment' work package of this project, the aim of which is to establish the preconditions for this new device. Additionally, TNO is a partner in other work packages concerned with testing the device in the field, developing a database for risk assessment, setting up a Nanosafety Forum, and a manual for the safety of produced nanoparticles.

FP6 AMBIO

In this project TNO's expertise is used for making structured surfaces that prevent or reduce interactions with organisms in the sea. Modification of nanoparticles allow the structure of the surface to be adapted.

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TNO is a leading, independent knowledge institute that uses its expertise and research to make a key contribution to the competitiveness of companies and organisations, to the economy and to the quality of society as a whole. TNO is unique in its versatility and capacity to integrate this knowledge.

TNO has some 4300 professionals.

- TNO works from five core areas:
- TNO Quality of Life
- TNO Defence, Safety and Security
- TNO Science and Industry
- TNO Built Environment and Geosciences
- TNO Information and Communication Technology

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