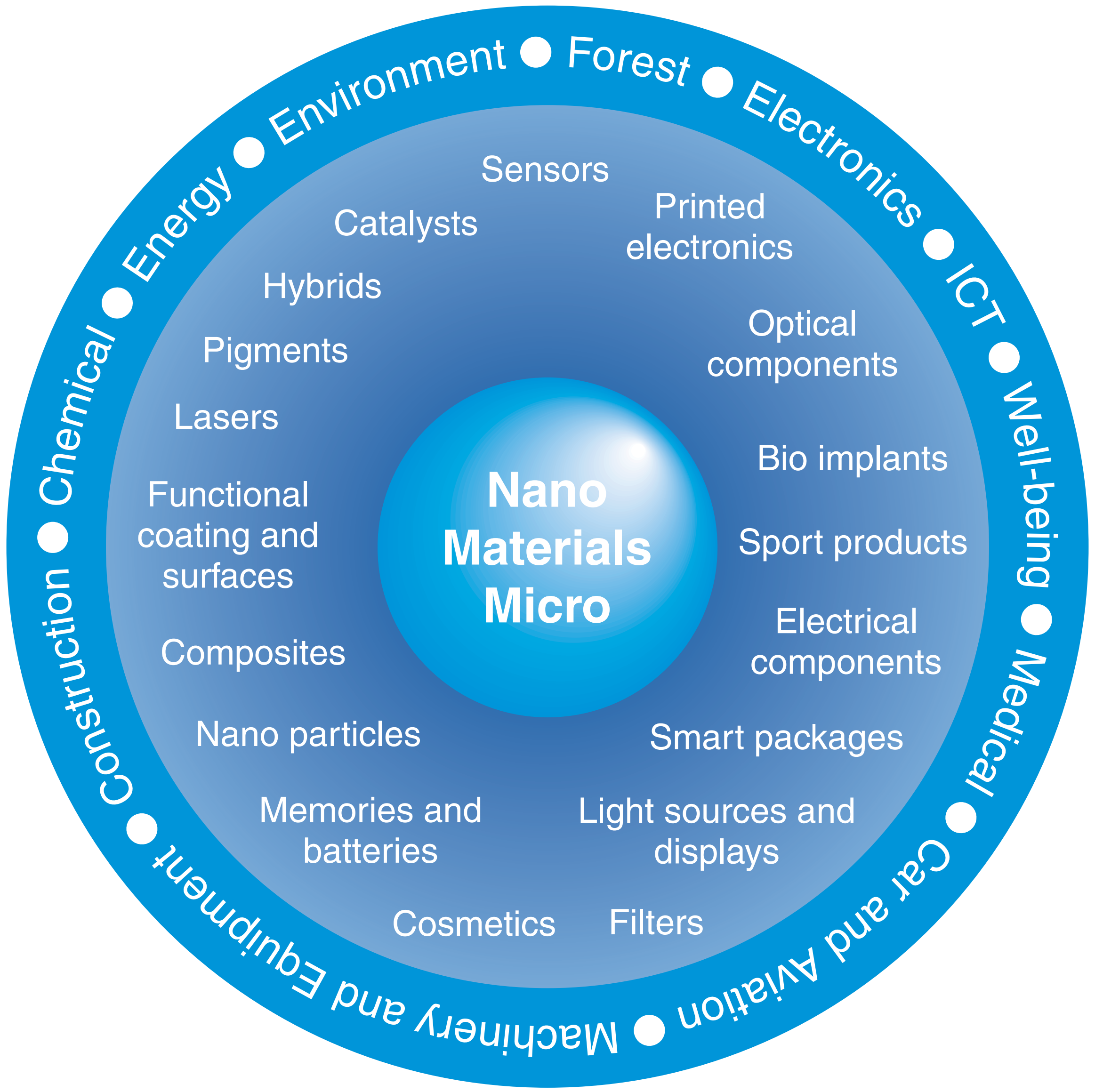

OSKE
NANOTECHNOLOGY CLUSTER PROGRAMME

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Gateway to Finnish Expertise

Nanotehnology has been chosen as a strategic focus area in Finland. The mission of the Nanotehnology Cluster Programme is to foster and strengthen the development and implementation of nano and micro technologies and future materials in Finnish companies. Accordingly, the Cluster Programme combines world class expertise in universities, research institutes and technology companies all over Finland, and aims at applications in industries like ICT, electronics, mechanical engineering, construction, forest, energy, environment, chemical, health and well-being. Nanotechnology Cluster Programme is an efficient gateway to the Finnish expertise in nano and closely related technologies.

OSKE
CENTRE OF EXPERTISE PROGRAMME

Making nanotechnology happen
- From science to industry

Main fields of expertise

Functional and self-assembled nanostructures and materials

Novel functional nanomaterials are the basis of newly emerging nanotechnologies for various device applications. Although nanotechnology research is primarily exploratory, there are high expectations for true applications. Nanotechnology based research is widely carried out in Finland and many research groups are internationally recognized to be some of the leading experts. Carbon nanotubes and other carbon based materials, variety of nanoparticles, polymeric materials and biomaterials are used to build up functional self-assembled nanomaterials having e.g. magnetic, optic or electronic properties. Application areas are e.g. sensors, photonics, separation, drug delivery and biomolecular electronics.

Focus areas:
- Functional materials based on self-assembly and its hierarchies
- Supramolecular and nanochemistry
- Bionanomaterials
- Carbon based nanomaterials
- Theoretical nanoscience
- Nanoelectronics
- Molecular recognition
- Nanocrystals

Integrated multi-technology micro and nanotechnology products

Nanotechnology integrated to microtechnologies presents a completely new spectrum of opportunities for building devices, components and systems. The theoretical understanding of the integration forms the basis for 3D design and modelling of nanostructured composite materials and for the utilised structures to produce functionality in components. Materials and processing methods have to have crystallographic and electric analysis and characterisation in nanoscale and in macroscale. Integration technologies such as ceramics, silicon and polymer can be utilized as a versatile platform for a packaged system.

Focus areas:
- Printed electronics and optics, biosensors
- Optical measurement & Integrated micro modules
- Development of processes compatible with conventional microelectronics production to enable the manufacture of functional nanostructures
- Design, fabrication and testing of micro- and nanosystems
- Integration of nanostructures in printed electronics and micromodules

Environment, health and safety

The new properties of nanoscale materials can also mean unforeseen risks and impacts for the environment and people who are in contact with the materials. Environmental and health effects depend not only on the composition and size of the particles but also on the surface and shape of those. When evaluating the safety risks the exposure to these materials has to be taken into consideration. The exposure can occur when producing particles, integrating these into system, manufacturing or using the final product or when demolishing the product and recycling the materials.

The commercialisation of innovations in nanotechnology and consumers confidence on safety requires research and risk assessments of environmental, health and safety effects of products. The use of new materials in Europe is regulated by REACH (Regulation, Evaluation and Authorization of Chemicals) law. REACH defines material producers and import organisations to be responsible for registration, safe use of chemicals and assessment of environmental and health risks.

Focus areas:
- development of risk assessment methods
- development of analytical methods
- follow up of laws and regulations related to the nanotechnology
- informing industry about risks, laws and regulations.

Future materials

Future materials are developed to enable the renewal of the main Finnish industry clusters. Application areas are e.g. construction and packaging materials, printable electronics, optics and optoelectronics, sensors and functional metals and alloys. Future materials provide properties like increased strength, lightness and functional surfaces.

Focus areas:
- ALD-technology
- Hard and scratch resisting surfaces
- Functional structures
- Biocompatible and biomimetic materials
- materials
- Polymer composites.

Metallic nanoparticles and compounds

Nanomaterials will be “commodity chemicals” in near future. It has been estimated that in 2020 one third of metal oxides produced will be in nanoscale. Metallic chemicals are important materials in many industrial applications: production of catalysts for drugs, oil refinery, pulp and papers industry, production of fine chemicals and energy as well as for powder metallurgy. Metallic chemicals can also be used in paint and colour production and rubber industry. Self cleaning, stronger, lighter and more wear resistant materials can be produced with metallic nanoparticles. They can also be used to develop optical, antibacterial, fire resistant and non oxidizing properties of materials.

Focus areas:
- synthesis and production of nanoparticles
- structure, surface and surface chemistry of nanoparticles
- process scale-up from laboratory production to industrial manufacturing
- applications and use conditions.

Photonics and precision technologies

Photonics is an outgrowth of the first practical semiconductor light emitters invented in the early 1960s. Economically important applications for semiconductor photonic devices include optical data recording, fiber optic telecommunications, laser printing, displays, and optical pumping of high-power lasers. The potential applications of photonics are virtually unlimited and include chemical synthesis, medical diagnostics, on-chip data communication, laser defense, and fusion energy to name few interesting examples. Photonics is closely related to optics.

Wave-optical engineering exploits the wave nature of light allowing the control of electromagnetic field with microstructures. Even complex optical functions can be implemented by fabricating components with feature of the size of the wavelength. Various branches of industry use microstructured components in their products. Diffractive optics and precision technology enable individual optical components and solutions in spectral imaging devices, beam shaping and dividing applications as well as display and lightning devices. Further applications arise from the decorative and security features of micro components.

Focus areas:
- Semiconductor technology
- Ultra-fast and intense optics
- Diode and fiber lasers
- Micro-, nano- and biophotonics
- Optical coherence and quantum optics
- Spectral colour technology
- Optical materials technology
- Precision manufacturing.