

Nanotechnology *in Helsinki Region*

EXAMPLES OF
NANOTECHNOLOGY RELATED
RESEARCH ORGANISATIONS
AND COMPANIES

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The Centre of Expertise Programme and nanotechnology in Helsinki Region



The Centre of Expertise Programme is a fixed term (2007 – 2013) programme aimed to improve the utilization of the highest international standard of knowledge and expertise. The programme is funded by the Ministry of Employment and Economy. Each of the 13 chosen strategic focus areas – nanotechnology being one of them – forms a nationwide cluster consisting of a network of local Centres of Expertise supported by a national level coordination.

Nanocluster involves local Centres of Expertise in Helsinki Region, Joensuu, Jyväskylä, Kokkola, Mikkeli, Oulu, Tampere and Turku and it reaches more than 90% of the Finland's nano- and microtechnology and new materials related activities and stakeholders. The aim of Nanocluster is to foster the responsible growth of Finnish nanotechnology related business. www.nanocluster.fi



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In Helsinki Region the Nanotechnology Centre of Expertise is hosted by Culminatum Innovation Oy Ltd which is a non-profit development company of Helsinki Region. The company is owned by academia, municipalities and business sector through a triple-helix ownership. www.culminatum.fi

Helsinki Region plays a special role in Finnish nanotechnology, as more than half of all the country's activities and stakeholders in the field are located here. This includes companies, research organizations and other private and public actors – some of which are introduced in this leaflet.



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Aalto University

Aalto University is a new multidisciplinary science and art community in the fields of science, economics, and art and design. The new University is founded on Finnish strengths, and its goal is to develop as a unique entity to become one of the world's top universities. Aalto University's cornerstones are its strengths in education and research.

At the new University, there are 20,000 basic degree and graduate students as well as a staff of 4,500 of which 300 are professors. The total budget for 2009 was close to EUR 368 million. In 2009, a total of 1,567 Master's Degrees and 180 Doctorates were completed at the three Schools. The number of alumni totals 75,000.

In Aalto University there are around 20 research groups related to nanotechnology in the departments of Advanced Energy Systems/New and Renewable Energy Systems, Automation and Systems Technology, Biotechnology and Chemical Technology, Communications and Networking, Electrical Engineering, Electronics, Engineering Physics, Forest Products Technology, Materials Science and Engineering, and Micro and Nanosciences. Research topics include for instance nanoelectronics and nanophotonics, thin layers, integrated bionanosystems, nanoparticles and nanotubes and self-assembled polymeric nanostructures, and theoretical research and modeling.

Micronova in Otaniemi, is a unique center around 2600 m² clean-room and production facilities focusing on the design, development and fabrication of micro- and nanosystems. It is run jointly by the VTT Technical Research Centre of Finland and Aalto University. Nano building is a newly renovated building on the Otaniemi campus housing several research groups that study nanoscience and nanotechnology, including synthesis of functional materials based on self-assembly as well as synthesis of carbon nanotubes and nanoparticles. The facilities include the new National Microscopy Centre of Finland.

www.aalto.fi





University of Helsinki

The University of Helsinki concentrates on high-level scientific research and researcher education. The number of faculties is eleven. There are around 39 000 degree students and 8 000 staff. The number of degrees taken each year is almost 4 300, of which 380 are doctorates.

Kumpula campus

The Kumpula campus is the largest centre of natural sciences in the Nordic countries. It houses the Departments of Physics, Chemistry, Mathematics and Statistics, Computer Science, Geology and Geography of the Faculty of Science of the University of Helsinki. The Faculty strives to maintain top-level research and teaching standards in all its disciplines: space research, basic research in the environmental science, materials- and nanoscience, computational science, data analysis, geoinformatics, teacher education, methodological disciplines.

The Kumpula Campus is one of the most significant nanotechnology research centres in Finland. There is top-level research for instance in aerosols, carbon nanotubes, graphene, and ALD applications.

Viikki Campus

The multidisciplinary Viikki Campus is a remarkable centre of biosciences at the European level. Viikki presents excellent opportunities for high-quality research and its practical applications. In addition to biosciences, the campus houses also a wide range of researchers in other areas of science: represented areas are for example environmental and veterinary sciences, food technology and economics. The Faculties of Bioscience and Pharmacy, Institute of Biotechnology, Department of Biochemistry and Drug Discovery and Development Technology Center carry out nanotechnology related research.

Meilahti Campus

The Faculty of Medicine in Meilahti Campus carries out high-quality multidisciplinary research, trains skilled doctors and dentists, supervises postgraduate education, and aids

researchers and students in establishing international contacts. Some 2,500 students are currently pursuing an undergraduate degree or postgraduate education in the faculty.

Nanotechnology research in Meilahti Campus is carried out for instance in the groups studying biomembranes and biophysics.

www.helsinki.fi/university

VTT Technical Research Centre of Finland

VTT Technical Research Centre of Finland is the biggest contract research organisation in Northern Europe, offering R&D services that help its customers to create new products, production methods and services and generate new business through technology and innovation. VTT is a non-profitmaking research organisation.

VTT is able to combine large spectrum of interdisciplinary know-how and resources when developing new nanotechnologies. It has modern facilities for processing micro and nanoelectronics, processing of nanocoatings and compounds, nanoparticle production, printed products, bionanotechnology and nanoparticle safety related research. VTT has a strong emphasis on the applied nano research aiming for industrially applicable results. Common property for the developed nanomaterials and structures is functionality, which brings new properties to the materials making them more suitable for their applications or enables them to replace more complicated structures.

www.vtt.fi





The Centre for Metrology and Accreditation MIKES

The Centre for Metrology and Accreditation makes internationally accepted measurement units and services. MIKES metrology realizes the SI system measurement units in Finland, performs high-level metrological research and develops measuring applications. The modern way of realizing the SI-units is based on nanoscale phenomena. Thus, reliable nanoscale measurements are connected with quantum metrology and constants of nature. Metrology is also enabling technique for developing technologies. IC-, lithography and nanofabrication need accurate tools for nanoscale production and quality control. Traceability for nanoscale dimensional metrology is provided by MIKES advanced laser interferometers, diffractometers and quantitative atomic force microscopes. MIKES is also developing traceable measurement applications at nanoscale range, with such techniques as Metrological Coulomb Blockade Thermometer.

www.mikes.fi



Finnish Institute of Occupational Health FIOH

Finnish Institute of Occupational Health FIOH is a research and specialist organization in the sector of occupational health and safety. The research aims at results to put in quickly into practice in Finnish working life, but also long range results seeking, disease mechanisms and determining the theoretical basis for phenomena for instance.

Finnish Institute of Occupational Health established as of January 1, 2011 'Nanosafety Research Centre' responsible for the coordination and leading of all research aiming at exploring all issues of safety of nanomaterials. This includes research on nanoparticle characterization, assessment of exposure to nanoparticles, nanotoxicology, risk assessment and management of nanoparticles, and risk communication related to nanoparticles and nanotechnologies.

www.ttl.fi

Finnish Meteorological Institute FMI

FMI produces high-quality observational data and research knowledge about the atmosphere, combining its know-how into services to benefit of mankind and environment. Expertise on research lays the foundation for FMI's own weather and climate service production and tailored services for various actors in the society. Various technologies for nanoclusters production as well as atmospheric new particles formation

events are based on nucleation phenomena. FMI is conducting basic research on formation of nanoclusters via nucleation processes and how these particles can influence climate and health.

www.fmi.fi



CSC - IT Center for Science

CSC - IT Center for Science is a non-profit company providing IT support and resources for academia, research institutes and companies: modeling, computing and information services. CSC provides Finland's widest selection of scientific software and databases and Finland's most powerful supercomputing environment. CSC provides nanotechnology modeling services to various universities and research institutions.

www.csc.fi



KCL – Oy Keskuslaboratorio – Centrallaboratorium Ab

KCL is a private research service company. KCL serves the global paper and related industries as well as the end-users of paper and board products by offering wide range of pilot testing services. All this under one roof. We support our customers in developing their existing products and moreover in introducing totally new products. Renewal of the forest cluster is our mission.

www.kcl.fi





Beneq – Equipment, Applications and Technology

Beneq is a supplier of equipment and coating technology for global thin film markets. Beneq turns innovations into success by developing applications and equipment for cleantech and renewable energy fields, especially in glass, solar and emerging markets. Coating applications include optics, barriers and passivation layers, as well as energy generation and conservation. Beneq also offers complete coating services. Beneq's coating applications are based on two enabling nanotechnology platforms: Atomic Layer Deposition (ALD) and aerosol coating (nHALO® and nAERO®).

www.beneq.com



Canatu – Nanobud™ Based Electronic and Optical Thin Film Components

Canatu manufactures a new class of versatile carbon based components based on its novel NanoBud™ nanomaterial. These components improve the performance and reduce the cost of optical and electrical devices while simultaneously reducing their environmental footprint. Canatu offers high purity Single-Wall Nanotubes and NanoBuds™ on client substrates and Joint Development Projects in cooperation with clients to develop specific commercial applications. Canatu is currently scaling the production process for industrial use.

www.canatu.com



Carbodeon – Superhard Nanomaterials

Carbodeon is a Finnish technology company specialized in development, manufacturing and application of carbon based highly specialized materials. The current product portfolio is comprised of both nanodiamond and carbon nitride materials. Our nine different grades of nanodiamonds possess each the desired properties fine-tuned for a growing number of dedicated applications. These grades are sold under the name uDiamond®. Carbodeon Nicanite® graphitic carbon nitride materials can be converted to carbon

nitride film coatings with unique properties . It is particularly beneficial to produce Nicanite® thin films and coatings by applying Picodeon Coldab® laser deposition technology.

www.carbodeon.com

DIARC

DIARC-Technology is an expert in the field of coating technology and specialises in the development and manufacture of unique thin film coatings for industrial applications. Company's product range includes ultra low-friction, highly wear-resistant diamond coatings for machine parts and tools, nanocoatings for functional applications and diamond and special metal coatings for decorative purposes.

DIARC coatings improve the surface properties of materials so that they function better in their target application. Coatings can be applied on all materials from metals and ceramics to plastics. DIARC offers a versatile coating service to its customers, which usually are leading companies in their fields in Europe, Asia and North America. In R&D DIARC works in close co-operation with universities, research institutes and companies.

www.diarc.fi



Genano – Air Purification Units

Genano is a Finnish manufacturer of air purification units. Using patented Genano® technology, Genano isolates even smallest nano-sized particles and harmful gases from the air. Genano air purifying systems are used in hospitals, laboratories and places where indoor quality may cause a health risk eg. sick building syndrome. By purifying the smallest particles and gases from the air it is possible to protect people as well as improve manufacturing processes. A wide range of applications are benefiting of Genano air purifiers from welding shops to hospital isolation wards.

www.genano.fi





Nanol Technologies – New and Revolutionary Lubrication Technology

Nanol is a patented discovery and represents a new generation of lubricants, which does not only reduce the wear of surfaces due to friction but practically eliminates it, thanks to a thin protective layer formed by copper nanoparticles contained in the lubricant. The secret behind Nanol lubrication technology lies within the precise amount of perfectly distributed copper nanoparticles, constructing a physical layer of copper atoms only on the surfaces of friction. The formed layer lowers the friction, protects the working surfaces from wear and corrosion and improves heat transfer from the friction zone. Nanol works well in both large- and small-scale engines, as well as other surroundings where heavy friction occurs and the need of lubricants is inevitable. Benefits from using Nanol will be higher engine efficiency, lower fuel and oil consumption, better reliability and longer lifetime of components and less harmful emissions.

www.nanoltechnologies.com

nLIGHT Corporation

The logo for nLIGHT Corporation consists of the word "nLIGHT" in a white, sans-serif font, set against a dark blue rectangular background.

nLIGHT is developing and manufacturing high-power semiconductor lasers, optical fibers, fiber components and fiber lasers using industry-leading innovations. Optimizing components and sub-systems for OEM integration produces differentiated advantages for our customers in industrial, medical, defense and consumer applications. Global support is offered through state-of-the-art manufacturing and application centers in Vancouver, WA; Hillsboro, OR; Lohja, Finland and Shanghai, China.

www.nlight.net

nGLASS – Glass Tiles

The logo for nGLASS features the word "nGLASS" in a bold, lowercase, sans-serif font, with a stylized 'n'.

nGlass's tiles are made from 100% glass. A new revolutionary colouring technique makes it possible to achieve a unique penetration of colour. The surface of the glass tile is heated with a 2000°C flame which gives a beautiful special

reflection into the glass tile when light beams hit the surface. The tiles can be used for example in halls, bathrooms, kitchens, pools, facades and many other places. nGlass manufacture curved, tinted and patterned glass tiles according to customer's requirements.

www.nglass.fi

Nokia – Connecting People

Nokia is the world leader in mobility, driving the transformation and growth of the converging Internet and communications industries. We make a wide range of mobile devices with services and software that enable people to experience music, navigation, video, television, imaging, games, business mobility and more. Developing and growing our offering of consumer Internet services, as well as our enterprise solutions and software, is a key area of focus. We also provide equipment, solutions and services for communications networks through Nokia Siemens Networks.

Nano Sciences System Research Center develops nanotechnologies for mobile communication and ambient intelligence. Studying physical, chemical and biological phenomena and manipulation of matter at the nanoscale enables generation of knowledge for enhancing human capabilities.

www.research.nokia.com

The Nokia logo is displayed in a bold, blue, sans-serif font.

Okmetic – Silicon Solutions for Advanced Technologies

Okmetic is a technology company which supplies tailor-made silicon wafers for sensor and semiconductor industries and sells its technological expertise. Okmetic provides a wide range of MEMS sensor-optimized silicon for various leading-edge technologies. Their process and design tailored solutions are the platform for the development of new generation applications and effective volume production. Okmetic's customers are global forerunning companies that manufacture cutting-edge solutions for security, safety, health, wellness, the environment, and entertainment.

www.okmetic.com

The Okmetic logo is displayed in a bold, blue, sans-serif font.

Orion Diagnostica – Rapid Solutions for Healthcare and Hygiene Monitoring



Orion Diagnostica Oy is part of Orion Group, the leading healthcare company in Finland. Orion Diagnostica specialises in rapid and easy-to-use clinical diagnostic and hygiene monitoring products. Most of the company's products are designed to assist health care professionals in doctors' offices, healthcare centres and hospitals in diagnosing patients' conditions, making appropriate treatment decisions and following up treatments. Nanotechnology has an essential and important role in Orion Diagnostica's present product portfolio.

www.oriondiagnostica.com

Picodeon – Surface Freedom™ – Making the Impossible Possible



Picodeon's Coldab® process makes thin films and coatings on 2D surfaces. The quality and characteristics of the produced thin films can be tuned according to the requirements of the customer applications. Picodeon produces today amorphous or micro crystalline films. The films can be anything from smooth to structured films; the common nominator is generally the good adhesion of the films to the product surface. Coldab is a large area extension of conventional pulsed laser deposition (PLD) and it is scalable to 300 mm wide 2D products.

Picodeon has successfully deposited various ceramic (oxide or nitride), compound semiconductor, carbide, metallic and polymer as well as DLC films on materials from silicon and glass to metals, silicon, and polymers.

Picodeon has a special focus on thin film coating made with Coldab® using novel Nicanite® carbon nitride target material by Carbodeon Ltd Oy. These films have properties that are a combination of hard but elastic as well as transparent, chemically inert amorphous films. Some descriptive data of the films:

- High transparency (> 90%) for a wide range of wavelengths
- Refractive index above 1,9 at 632,8 nm wavelength
- Tunable pencil hardness, more than 9H and increasing
- Excellent adhesion

- High thermal conductivity
- Stable to above 600°C and chemically inert

www.picodeon.com

Picosun – The Ald Powerhouse

Picosun Oy is a Finnish, globally operating manufacturer of state-of-the-art ALD systems for micro- and nanotechnology applications, representing exclusive dedication and continuity to over three decades of ALD reactor design. ALD was invented by Picosun Board Member Dr. Tuomo Suntola in Finland in the early seventies and today Picosun's SUNALE™ ALD systems are used by high profile industries and leading research organizations across four continents. The company's worldwide sales and service organization provides its customers top level coating solutions with user-friendly, reliable and productive ALD tools which, due to their uniquely scalable design, allow smooth transformation from R&D to production.



www.picosun.com

Planar Systems – Display Solutions

Planar Systems, Inc. is a leader of specialty display technology solutions for the world's most demanding environments. The latest Planar products utilising nanotechnology are IR-blocking filters. Traditionally Planar utilises nanotechnology in the Electroluminescent (EL) manufacturing process for making the display glass. Major part of the process is done in Finland.

EL displays are designed for extreme temperature and vibration conditions, where viewing properties and endurance are of utmost importance. EL applications include medical equipment, transportation, armoured vehicles and industrial equipment. Globally Planar offers a wide range of display products for industrial, medical, commercial and home theater segments. As a display specialist Planar offers customised projects in addition to wide catalog of display products.



www.planar.com

Silvergreen



Silvergreen Ltd is an innovative company specializing in material technology of polymeric coatings. We have developed a range of products based on nano-coating and silver technology using our own production facilities. The product range covers a wide spectrum of solutions for many application areas of functional materials. Our offering includes a range of antimicrobial SG paints, water and dirt repellent coatings, antibacterial conducting textiles and special fibers among others. All operations at Silvergreen are build on safety, continuity, innovativity and REACH regulations. The testing of proper product functions is carried out by independent special institutions on materials and public health, especially by THL (The National Institute for Health and Welfare).

www.silvergreen.fi

Teknos – Paints and Coatings



Teknos is one of the leading suppliers of industrial coatings in Scandinavia and Central Europe with a strong position in retail and architectural coatings, too. Group companies operate in Scandinavia, Germany, the UK, Poland, Slovenia, Russia, Ukraine and China and through a well-established network of agents and representatives in about twenty other European countries.

Teknos' strengths lie in its strong technical know-how, supported by sustained investment in R&D, and a desire to become the preferred Paint Partner of all of its Customers. Teknos follows actively the nanotechnology development and has already adapted the new technology in some products.

www.teknos.fi

Tikkurila – Inspiring You to Color Your Life



Tikkurila provides consumers, professionals and industrial users with user-friendly and environmentally sustainable

solutions for protection and decoration. Tikkurila is a strong regional player that aims to be the leading paint company in the Nordic area and Eastern Europe including Russia.

The principal objective of Tikkurila's product development is to meet the changing needs of customers, with environment issues and product safety in mind. At Tikkurila, nanotechnology's potentials are constantly being evaluated, and some nanomaterials have already been used for years in product applications.

www.tikkurila.com

Vaisala – Electronic Measurement Systems

Vaisala develops, manufactures and markets products and services for environmental and industrial measurement. Vaisala's markets are global. The mission is to provide basis for better quality of life, environmental protection, safety, and productivity. The major customer groups are meteorological and hydrological institutes, aviation organizations, defense forces, road and rail organizations, weather related private sector, system integrators and industry worldwide. Vaisala is the global market leader in many of its core businesses.

The logo for Vaisala, consisting of the word "VAISALA" in a bold, blue, sans-serif font.

www.vaisala.com

VTI Technologies – Forerunner In Motion Measurement

VTI Technologies is a global market leader of low-g acceleration sensors for automotive industry applications and Cardiac Rhythm Management (CRM). Application areas for the company's motion sensors include the automotive industry, medical, instruments as well as consumer electronics. Nanotechnology helps VTI Technologies to control critical properties of the MEMS devices that affect their stability and reliability. VTI Technologies participates actively in the Finnish nanotechnology research.

The logo for VTI Technologies, featuring the letters "VTI" in a large, bold, red font, followed by a stylized red icon of a cube or box, and the word "TECHNOLOGIES" in a smaller, red, sans-serif font below it.

www.vti.fi



VTT Memsfab Oy - Contract Manufacturing of MEMS Solutions

VTT MEMSfab Oy offers contract manufacturing services and design support based on the following micro and nanotechnologies:

- Surface MEMS and MOEMS (microelectromechanical systems)
- Superconductive devices
- Other silicon-based devices and processes

Our products are typically partly or fully processed wafers, which can be delivered undiced or diced on a dicing tape. Wafer-level encapsulation can also be offered. We make use of the high-class fabrication facility and the extensive equipment base in Micronova. Production volume can range from a few wafers up to thousands of wafers yearly.

www.vttmemsfab.com



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