

Finnish-Russian Nanotech Partnering
PROGRAM | 24.11.2009



Welcoming words

Dear participants of the Nanotech Partnering event,

Collaboration in innovation is becoming increasingly international, with global knowledge communities formed by members located in different places.

This is also evident in the innovation cooperation among Finland and Russia: the key actors are actively seeking for the best expertise and strategic partners across the border.

The Innovation Working Group under the Governmental Economic Commission is paving the way for deeper collaboration in the field of innovation. I wish the Finnish-Russian Nanotech Partnering event will lead to longstanding strategic partnerships among our companies and research institutes and eventually strengthen their position in the global competition.



Antti Valle

Chairman of the Innovation Working Group
of Finnish-Russian Economic Commission
Ministry of Employment and the Economy, Finland



RUSNANO
Russian Corporation of Nanotechnologies

Use RUSNANO Resources to Realize Your Potential

- Unleash the opportunities of the growing Russian nanotech market
- Find new partners for high-tech business in Russia
- Use the advantages of Government support for nanotechnology industry

For more information please contact RUSNANO representatives at Finnish-Russian Nanotech Partnering event 24 Nov 2009, visit our website www.rusnano.com, or e-mail to Artem.Motorny@rusnano.com

Finnish-Russian Nanotech Partnering

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08.30 Coffee and registration, exhibition

09:00 Session I: Nanotechnology in Finnish-Russian co-operation

Chairman: Reijo Munther, Tekes

09:00 Opening words, Antti Valle, Ministry of Employment and Economy

09:10 Aleksei Sudarikov, Ministry of Science and education
in Russian Federation

09:20 Nanotech status globally vs Fin-Rus cooperation, Pekka Koponen, Spinverse

09:40 Prospects for Innovation Cooperation, Ilya Nadorshin, RUSNANO

10:00 Nanotechnology Cluster Programme and Otaniemi innovation hub,
Eeva Viinikka, Culminatum

10:30 Coffee Break, exhibition

11:00 Session II: Surfaces and materials

Chairman: Markku Heino, Spinverse

(Tekes Functional Materials program coordination)

11:00 Functional Coating Applications Enabled by Beneq's Aerosol
and ALD Technology, Tommi Vainio, Beneq

11:15 Prepreg sheets, Nikolay Sobolev, Nanotech Severo-Zapad (North - West)

11:30 Avalon® Hygienic Coatings, Petri Sorsa, Millidyne

11:45 Russian Nanostructured Vermiculite – Technological Background and
European Market Potential, Olav Eklund, RS+

12:00 Nanodiamonds, Asko Vehanen, Carbodeon

12:15 Water treatment equipment, Sergey Kryatov, CJSC Aquametosintez

12:30 Decorative glass tiles and other nanotech based new glass applications
for interior and architecture, Jussi Wright, nGlass

12:45 Hydrogenation catalyst, Valeriy Ukraintsev, LLC PhisTechPribor

13:00 Lunch & coffee, exhibition, matching event meetings

- 14:00 Session III: Nanotechnology in Electronics and MEMS
Chairman: Laura Juvonen, Spinverse (Tekes FinNano program coordination)
- 14:00 Nanotechnologies for future mobile devices and services,
Tapani Ryhänen, Nokia Research Centre
- 14:15 New generation of Li-on accumulators, Alexander Filippov, CJSC PLASMAS
- 14:30 Picosun – The ALD Powerhouse, Juhana Kostamo, Picosun
- 14:45 Development and production of analytical instruments,
Maxim Slyadnev, Lumex Ltd
- 15:00 Carbon nanotube and NanoBud™ thin films: Cost-effective solutions
for electronics, energy and beyond, David Brown, Canatu
- 15:15 Implementation of technology of fluoropolymer coating of details made
of aluminum alloy AK4 in manufacturing of gas pressure/flow regulators,
Kristina Ivanenko, Krass
- 15:30 Electronic and optical materials enabling next generation
semiconductor devices, Thomas Gädda, Silecs
- 15:45 MEMS/NEMS sensors fabrication in Moscow Institute of Electronic Technology
(MIET), Zelenograd: opportunities and prospects, Nikolay Dyuzhev,
Science-technology center “Nano- and microsystem technique”
- 16:00 [Transfer to Micronova, coffee](#)
- 16:30 Session IV: Micronova and Otaniemi Nano research facilities
- 16:30 Welcoming words & introduction to Micronova facilities,
V.-M. Airaksinen, TKK/Micronova
- 16:45 VTT Nano research, SVP Anne Ritschkoff, VTT
- 17:00 Nano House and Nanomicroscopy center, Professor Janne Ruokolainen, TKK
- 17:15 Reflections by the Russian Delegation, Oleg Ivanov, RUSNANO
- 17:30 [Networking buffé, Micronova posters](#)
- 18:00 [Tour at Micronova \(option: NanoHouse\)](#)

Session I: Nanotechnology in Finnish-Russian co-operation

Chairman: Reijo Munther, Tekes



Tekes (the Finnish Funding Agency for Technology and Innovation) is the most important publicly funded expert organization for financing research, development and innovation in Finland. Tekes boosts wide-ranging innovation activities in research communities, industry and service sectors.

Tekes promotes a broad-based view on innovation: besides funding technological breakthroughs, Tekes emphasizes the significance of service-related, design, business, and social innovations.

Tekes works with the top innovative companies and research units in Finland. Every year, Tekes finances some 1,500 business research and development projects, and almost 600 public research projects at universities, research institutes and polytechnics.

Research, development and innovation funding is targeted to projects that create in the long-term the greatest benefits for the economy and society.

Networking

Tekes welcomes international partners to join its innovation network to find new solutions to common challenges. Tekes is one of the gateways to collaborating with the most important

research and development partners in Finland. Tekes programmes are forums for the exchange of information and networking between businesses and research groups. They provide opportunities for carrying out ambitious R&D projects and for developing business expertise and international cooperation. Moreover, the programmes provide a gateway to collaborating with the best research groups and innovative R&D companies in Finland.

Mr. Reijo Munther is acting in Tekes as a Director for Materials Technology activities.

Nanotech status globally vs Fin-Rus cooperation

Pekka Koponen, Spinverse

SPINVERSE
Capital & Consulting

9:20

The general perception of a new technology typically evolves from early fascination through over-enthusiasm to consequent disappointment due to unrealistically high expectations compared to the timescale. In the meanwhile, technology development has continued behind the scenes and is only just beginning to bear fruit.

On a global scale, nanotechnology is currently going through such evolution. During the last decade, substantial investments have been made to fund nanotechnology research and infrastructure. Today we are only just seeing the emergence of the first genuinely valuable applications. The recent economic downturn has also had its impact and further public funding may be critical to secure the commercial development of nanotechnology.



Pekka Koponen, Founder and CEO of Spinverse, has strong international experience in emerging technologies and markets. Pekka joined Nokia 1990

as a smart card expert for company's first GSM phone. During the following 14 years he gained experience in R&D, strategy, marketing, sales and creating new ventures. His extensive international career includes expatriate assignments in China, Singapore, UK and Czech Republic. Pekka's last position at Nokia was Partner in Nokia's spin-off fund and before that Director of Strategy & Business Development at Nokia's Software & Services-unit.

At Spinverse Pekka has created a platform for his passion for bringing new technologies to market, driving the growth of new business and building partnerships. He is especially known for his work in commercializing nanotechnology and as a behind-the-scenes dealmaker for the most respected organizations on the planet.

Pekka has a M.Sc. degree in Computer Science and Engineering from University of Oulu and an MBA from IMD in Lausanne, Switzerland, Europe's top business school.

Prospects for Innovation Cooperation

Ilya Nadorshin, RUSNANO



POCHAHO
Инновационное партнерство России и Финляндии

9:40

The presentation will cover the following topics:

- Russian Nanotech Industry;
- Russian Corporation of Nanotechnologies (RUSNANO);
- Key Financial Indicators;
- Support for co-investors;
- Investment Project Selection Mechanism

Nanotechnology Cluster Programme and Otaniemi innovation hub

Eeva Viinikka, Culminatum Innovation



Nanotechnology Cluster Programme belongs to the Centre of Expertise program coordinated and funded by the Ministry of Employment and the Economy and by the local municipalities. The 13 clusters of the program provide a unique platform for multidisciplinary cooperation, exploited effectively by the Nanotechnology Cluster Programme to support the growth of nanotechnology know-how based business. Nanotechnology Centre of Expertise in Helsinki Region – one of the seven offices in Finland – provides a practical example of the activities. The centre offers a multidisciplinary, independent contact point to all nanotechnology stakeholders in the Helsinki metropolitan area, which includes more than half of the Finnish nanotechnology related activities. The services include supporting the penetration of the nanocompanies' products to new markets through networks and piloting environments, tailored partnering, networking and project build up.

Otaniemi Technology Hub is the leading technology hub in the Nordic countries, featuring a unique mix of world-class research organizations, academic institutions and over 600 companies from start-ups to multinational corporations operating around a compact 2 kilometer campus. Twice selected by the EU as one of the most innovative regions in Europe, Otaniemi is a community of over 32,000 people with 16,000 students and 16,000 technology professionals. The innovation support includes 10 organizations very close to each other both in location and in cooperation.



Dr. Eeva Viinikka is the Program Director at Culminatum Innovation and she is responsible for Nanotechnology Centre of Expertise in Helsinki Region. Her previous positions include

new MEMS wafer development and technical customer support at Okmetic Oyj, a silicon wafer manufacturer and a worldwide market leader for MEMS wafers. Her PhD (Helsinki University of Technology, 1999) thesis considered the electrochemistry of conductive polymers and her master's thesis compatibilization of polymer blends. She has been running the Nanotechnology Centre of Expertise in Helsinki Region since 2007. The Centre has continuously been ranked among the best both within the Nanotechnology Cluster Programme and within Culminatum Innovation.



Chairman: Markku Heino, Spinverse
(Tekes Functional Materials program coordination)

The Functional Materials Programme launched in 2007 aims to develop new applications and competitive advantage through material technologies for Finnish industry. The proposed overall funding for the Programme is 205 M€, of which Tekes accounts for 84 M€. Tekes, the Finnish Funding Agency for Technology and Innovation, is the main public financing organization in Finland. Currently the Programme is funding 28 university driven research projects and 25 industry projects, with altogether over 100 Finnish industrial companies involved. The high involvement of industry partners is partly due to the Tekes' concept of consortium research projects, in which public research organizations, universities, and companies join forces effectively. The Programme covers several areas including understanding materials properties, control and tailoring of materials and functionalities, processing aspects, and new materials based applications. Environmental aspects and life cycle management are key issues through out the Programme.

The overall aim is to develop functional materials based solutions for several different industry sectors in Finland leading to new businesses and renewing the industry. The Programme activates companies and research groups for focused partnering, helps in building

international cooperation and multi-disciplinary research consortia and competence networks in specific areas.

The focus is put on five themes:

1) Biomaterials, 2) Low-cost mass manufacturing of intelligent structures, 3) Active materials and structures, 4) New energy technology materials, and 5) Environmentally sustainable material solutions. Road mapping work is currently being made by multi-disciplinary groups of specialists both from industry and academia to define more detailed application oriented focus for each area and to give guidelines for the future work. The end-user needs are taking into account and product value chains recognized to find the most critical areas and opportunities. International cooperation is needed to build global value chains and form world-class multi-disciplinary research consortia capable of transferring the results later towards applications.



Dr. Markku Heino is a senior consultant at Spinverse and is the programme coordinator for the Tekes Functional Materials Programme.

Functional Coating Applications Enabled by Beneq's Aerosol and ALD Technology

Tommi Vainio, Beneq



Beneq is a nanotechnology driven supplier of industrial equipment and technology for global markets. Beneq is turning innovations into success by providing nanotechnology enabled functional coating applications for cleantech and renewable energy areas especially in solar energy and photovoltaics and flat glass coatings for energy efficient buildings (low-e). The products include industrial and R&D equipment based on Aerosol (nHALO® and nAERO™) and Atomic Layer Deposition (ALD) technologies. Beneq has developed a strong IPR-portfolio of over 60 patent families to support the business targets.

ALD as a deposition method is already being used in large industrial scale in many areas including semiconductors and TFEL displays. The ALD applications Beneq has developed are in new areas outside of traditional semicon area and include several innovations which are protected by own IPR. Beneq's proprietary nAERO and nHALO technology enables the production of hard pyrolytic coatings on glass with higher deposition rate and lower cost of ownership compared to other glass coating methods (CVD, PVD). Beneq's current equipment offering includes e.g. stand alone batch production systems and in-line integrated coating tools.

Beneq's current main applications are:

- nCLEAR® - Enhanced photovoltaics and flexible electronics
 - Surface passivation of c-Si cells
 - Cd-free CIGS solar cells by ALD buffer
 - Moisture barriers for OLED displays and lighting
- Improved Li-ion batteries
- Barriers for flexible PV and electronics
- nERGY™ - Solar applications
 - TCO glass coatings for solar cells
 - Low emissivity glass for buildings
 - Antireflective coatings
- nHALO enabled glass coatings
 - New functional glass coatings for flat glass applications
- nOPTO™ - Optical coatings
 - Selective filters
 - Decorative coatings
- nSILVER® - anti-tarnishing coatings on silver
- R&D – research tools for industrial customers and research institutes.



Tommi Vainio started his professional career as Research Scientist in Helsinki University of Technology in 1991. His industrial career includes R&D positions in paper machinery

industry (Valmet Service, Finland, 1996-98) and a number of business management positions at Nextrom (ex. Nokia-Maillefer) in 1998-2005. Prior to joining Beneq in 2005 he was Managing Director of Nextrom Oy, Finland. Since 2005, as CTO and one of the founding members of Beneq, Tommi is responsible of technology and business development at Beneq.

He holds PhD in polymer technology (Helsinki University of Technology, 1996) and special know-how in international business management.

Prepreg sheets

Nikolay Sobolev, Nanotech Severo-Zapad (North - West)



11:15

Major lines of activity:

- Development of technologies and fabrication of polymeric composite materials based on thermoplastic matrices, including nanomodified composites;
- Development of technologies and fabrication of new composite materials for structural and tribotechnical applications;
- Fabrication of prepregs based on glass-fiber or kevlar textiles and a thermoplastic binder and processed at temperatures of up to 380 C;
- Fabrication of prepreg products using hot forming or winding onto a mandrel with welding of layers;
- Pilot production of end seals, bushings, and

journal bearing featuring high abrasive resistance and the high load capacity (up to 60 MPa) in combination with low friction coefficient for application in watercraft, hydraulic turbines and pumps lubricated with water or any other liquid;

- Fabrication of polymeric high voltage insulators featuring high thermal resistance;
- Development of technologies for consistent (elastic) greases with nanoadditives greatly improving antifriction, antiwear and antigalling characteristics;
- Development of technologies for hydrogenation catalysts and afterburning catalysts based on nanopalladium.

Avalon® Hygienic Coatings

Petri Sorsa, Millidyne



11:30

Millidyne Oy specializes in advanced materials and surface treatment technologies featuring benefits such as enhanced hygiene and cleanability, corrosion and wear resistance, and novel electrical properties.

Its Avalon® coatings are not only easy to keep clean, they are also very effective at preventing bacteria from living or multiplying on surfaces –

making the technology ideal for hospitals and food manufacturing plants.

Avalon® 22 have shown very conclusively that the coated material inhibits bacterial growth to a significant degree. Surfaces coated with Avalon® 22 have attained a low bacterial count some 100–1000 times faster than uncoated ones.

Russian Nanostructured Vermiculite - Technological Background and European Market Potential

Olav Eklund, RS+

11:45

The University of Turku, together with the Russian company PC+ Ltd, present an original patented technology that involves modifications applied to the crystalline lattice of the

natural mineral vermiculite from the Kovdor deposit, Russia. This modification occurs at the nanolevel that varies from 0.4–0.7 nm up to hundreds of nm, in terms of the cell size

and clusters of the crystals, respectively. The present project which was provided for evaluation of Rusnano, aims to obtain a brand-new, high-tech geomaterial GS-1, which can be used as an efficient filter and immobilizer of ammonium ion from variable polluting matters (waters, soils etc). A secondary product, ammonium-doped modified geomaterial termed herein GS-2, can be obtained during operations related to cleansing of the polluted environment. GS-2 thus becomes an efficient fertilizer for long-term period use and a soil conditioner. All the methods and products related to this development are novel, environmentally friendly and concerned with recycling.

Geomaterial GS-1 is able to absorb at least 3.1 wt% of ammonium into the A-site of its crystal lattice over a short time span. Such absorption is selective since other cations do not get absorbed though they can have a similar size and charge. Such selectivity opens various prospects for the use of GS-1 as a unique ammonium absorber for various polluted environments. Since its production, beginning in 2008 at Geosmart Ltd (Russia), it has been efficiently tested on waste water from a biogas plant, human urine, combustion experiments (fox excrements), industrial chimneys etc. Moreover, the ammonium-doped secondary geomaterial GS-2 was tested as a fertilizer in greenhouse experiments with seedlings. After five months, the weight of the plants that had grown in a substrate containing geomaterial GS-2 was 10 times the weight of plants growing in the reference substrate. More longer and representative tests are currently in progress to establish the ideal proportions of both geomaterials for their best efficiency.

These test results together with latest marketing research are currently used for commer-



cialization of both products GS-1 and GS-2 in Europe. The unique aspect of GS-1 for reduction of polluting ammonium and its reuse as a fertilizer (GS-2) for increased growth of trees has very significant business potential. There

is a substantial market for GS-1 in Europe. Its potential has been identified for both – liquid and gas pollution. The dry toilets market has been estimated as commodity business (B2C) while agriculture, industry and wastewater treatment plants are business to business markets (B2B). Environmental regulations within the EU act as functional drivers for the use of this product; likewise protection of the Baltic Sea from over pollution is another driver. In 5 years time this business can turn around 20 M€ just within Northern Europe and the area around the Baltic Sea.

Dr. Sci. Olav Eklund is professor of geology and mineralogy at University of Turku. He is specialised in bedrock geology, particularly igneous petrology and in mineralogy. In recent years he has been focusing on environmental mineralogy. Principally, his research is to find suitable cheap raw material for the environmental technology.

Ongoing projects in this field are

- Nanomodification of vermiculite for reduction of ammonium from different types of waste waters and reuse of the doped mineral as fertilizers.
- Research for suitable calcium carbonates for desulphurisation of coal power plants.
- Carbonation of magnesium bearing minerals and rocks.

Carbodeon Ltd Oy develops, manufactures and supplies superhard uDiamond® materials, where toughness is at a premium. Carbodeon Ltd Oy works in collaboration with JSC Diamond Center in Saint Petersburg, Russia. The parties are jointly planning a major investment for expansion of manufacturing capacity.

uDiamond® products can be used as additives to obtain new unique composite materials, or as new types of protective thin film coatings. They are typically round diamond particles with diameter of 3–5 nanometers. uDiamond® mainly enhances hardness, wear resistance, thermal conductivity and reduces friction.

Main application areas and corresponding main benefits of uDiamond® products are:

- Polishing and honing of optical and semiconductor materials, metals and ceramics. Polishing speed and surface quality increases significantly.
- Electroplating with metal-nanodiamond suspension. Microhardness and wear resistance improves typically 30–100%, while corrosion rate reduction of 30–80% is observed. Smoother, less porous and highly adhesive composite metal/nanodiamond layers can be produced. Significant savings with layer thicknesses are obtained.
- Additive in oils and lubricants. Nanodiamond in lubrication systems such as combustion engines, transmission systems, tools and hydraulic systems show 40% improved

wear resistance, 40% lower friction behavior and 5–10% fuel efficiency and power gain.

- Additives in plastics and rubber. Elastic strength, friction, abrasive resistance and thermal aging stability are improved by a factor of 2 to 4, when composite nanodiamond/polymer mixtures are used. Examples of applications include manufacturing of seals, stop valves and as protective and antifriction coatings. Composite fluoroelastomers can have friction coefficient values below 0.01.
- uDiamond® materials can be used in drug delivery systems, where nanodiamond particles containing antibiotics are injected to patients, significantly increasing the level of medication through increased selectivity of drug delivery to point-of-use.

SUPERHARD NANOMATERIALS FROM CARBODEON OY, WHERE TOUGHNESS REALLY COUNTS

Dr. Asko Vehanen works as CEO of Carbodeon Ltd Oy. After a Ph.D. degree from Helsinki University of Technology (HUT) and an academic career in materials physics at HUT and Brookhaven National Laboratory, Asko has worked 20 years in materials industry. In 1989 he joined Outokumpu Oyj to manage its Semiconductor Materials Group. Later he established several Okmetic group companies in Finland, Sweden and USA. In 2005 Dr. Vehanen founded Norstel AB (Sweden), manufacturer of Silicon Carbide semiconductor material.

12:15

Water treatment equipment Sergey Kryatov, CJSC Aquametosintez

Joint-Stock Company «AQUAMETOSINTEZ» was founded in 2000 in a period of occurrence in Russia of economic opportunities for construction and reconstruction of industrial enterprises and objects of housing and communal complex at high demand in structures and plants for purification of natural and sewage water. Formation of the company has occurred on the basis of production association «Technological equipment» of the Ministry of medium engineering. Financial and organizational support of Joint-Stock Company «AQUAMETOSINTEZ» was given by the group of companies “STOIK”.

Now Joint-Stock Company «AQUAMETOSINTEZ» is one of the leading Russian industrial and engineering companies, incorporating permanent scientific and technical council, technological and design departments, assembly and production shops, warehouse, specialized brigades for installation and commissioning of water treatment plants.

Priority directions of activity of Joint-Stock Company «AQUAMETOSINTEZ» are:

- Purification of superficial and underground waters of any category of complexity, used for systems of household and drinking water supply;
- Conditioning of water for thermal power stations and circulating water system;
- Production of deep purified water for food, chemical and radio-electronic industries;
- Purification of household, industrial and storm sewage.

Development of manufacturing schemes and plants designing is made out individually, in view of requirements of the Customer to the quality of the purified water and features of the object. High professionalism of the company employees is a basis for selection of the most rational and effective methods of water purification. Due to more than 25-years experience our specialists are the experts in the field of water purification.

Owing to high research, production and technical potential, fulfilled orders and client references Joint-Stock Company «AQUAMETOSINTEZ» can be named one of the leading Russian companies in the field of purification of natural and sewage water.

12:30

Decorative glass tiles and other nanotech based new glass applications for interior and architecture Jussi Wright, nGlass

nGlass is specialized in advanced and innovative glass processing. The company has developed a new production line where glass can be treated in high temperature to get different features on glass surface. nGlass business idea is to produce, based on its technological know-how highly refined and well designed

products for interior and architecture. nGlass also produces customer applications of glass elements for the industry.

Today nGlass product range include glass tiles, glass blocks and a special Kimallus “Glitter”

material which is produced of recycled glass. For glass tiles colouring nGlass can utilize nanotechnology applications to get specially bright and even colors on glass surface. This gives a beautiful reflection of light on glass surface. The company can offer a very flexible possibility to use coloured, shaped and patterned glass elements in architecture and design. This gives nGlass the advantage to be able to serve customers with special enquiries, besides having its own standard collections.

Today nGlass uses nanotech application for coloring glass. In the future also other features like the glass surface self cleaning and degree of UV radiation through glass will be part of nGlass product development. The special color effects on nGlass glass elements also give a great platform to develop different light

solutions to create fascinating interior and architecture solutions.



Jussi Wright, B.Sc. Glass and ceramic design. Managing director of nGlass 2000–2006 project coordinator and plant manager at ABR-Innova, an incubator and

business development company. Jussi worked in various research and development projects for glass and ceramics processing, specially high temperature coating and different technologies of glass colouring. He founded nGlass in 2006 as a spinoff from these projects and decided to specialize in glass processing and developing advanced products based on his technological know how.

Hydrogenation catalyst

Valeriy Ukraintsev, LLC PhisTechPribor

PhisTechPribor Company Limited was established on the 24th of May in 2001 by well known professors of the Saint-Petersburg State Technological Institute (Technological University), Saint-Petersburg International cooperation center and Saint-Petersburg large-scale enterprises leaders.

The scientific operations of the .company are located in the Saint-Petersburg State Technological Institute (Technological University) while the production takes place at Physical-Technocal Institute of A.F. Ioffe (Ioffe Pcisico-Technocal Institute of the Russian Academy of Sciences).

PhisTechPribor Co Ltd. operates with the most prestigious Russian scientific institutions (including Russian Academy of Sciences, Saint-Petersburg State Technological Institute

and Ioffe Pcisico-Technocal Institute to name a few) and with various international companies. The company takes active part in various exhibitions, conferences and competitions.

The director general of PhisTechPribor Co Ltd is N. Z. Sobolev.

Cardinal areas of the company development are:

High-Tech. technologies in area of

- catalysis (nanocarbon)
- constructional material
- Special chemistry
- sorption
- desorption
- radioprotection
- experimental medicine
- cosmetic substances

12:45

Session III: Nanotechnology in Electronics and MEMS

Chairman: Laura Juvonen, Spinverse
(Tekes FinNano program coordination)



FinNano, the Finnish national nanotechnology programme, was initiated in 2005 as a coordinated action by Tekes, the Finnish Funding Agency for Technology and Innovation and the Academy of Finland. During 2005–2010, the total investment to nanotechnology research and development is over 120 million euros.

Exploitation of nanotechnology innovations and commercialization are fundamental components of the Finnish nanotechnology initiative. Since the launch of the FinNano programme, the number of Finnish companies active in nanotechnology has more than tripled. There are currently over 200 active Finnish nanotechnology companies compared to the 61 that were identified in 2004. Of the companies operating currently, 65 had commercial products or processes in 2008.

Most of the companies utilizing nanotechnology operate in the chemical industry, information and communications technology, or the health and wellbeing sector. The number of companies utilizing nanotechnology has increased in all of the key sectors of Finnish industry. By 2013, it is estimated that the Finnish nanotechnology sector will grow to 1.2 billion euros and will employ 11,000–12,000 people in Finland. The webpages of the programme can be found at www.tekes.fi/finnano.



Dr. Laura Juvonen is a consultant at Spinverse, currently responsible for the coordination of the Tekes FinNano Programme. She is specialized in the fields of nanotechnology, materials science and computational engineering with experience ranging from scientific research to program coordination and event management. She has D.Sc. (Tech.) degree in Computational Materials Science and M.Sc. degree in Electrical Engineering from Helsinki University of Technology, Finland.

Nanotechnologies for future mobile devices and services

Tapani Ryhänen, Nokia Research Centre

14:00



Tapani Ryhänen received his Diploma Engineer (M.Sc.) degree in technical physics and his Doctor of Technology degree in electrical engineering from the Helsinki University of Tech-

nology in 1986 and 1992, respectively. He joined Nokia in 1995. He is currently heading Nokia's research laboratories in Cambridge and Lausanne. The laboratories are focusing on nanotechnologies and pervasive sensing to be applied in mobile devices and services. He is also responsible for Nokia's research collaboration with the University of Cambridge and the Ecole Polytechnique Fédérale de Lausanne (EPFL). Before his current role he was leading Nokia's strategic research in the

areas of future user interfaces, future device architectures and interfaces, mechanics and miniaturization. His previous work at Nokia also covers sensor technologies and applications, wellness and health applications, ambient intelligence, RF MEMS, microsystems, architectures and interfaces of sensor modules and mass storage solutions. He has authored over 70 publications on ultra-low noise superconducting thin-film magnetometers, noise theory, micromechanical sensors and actuators, biomagnetic measurements, nanotechnologies, and mobile phone technologies and applications. He has fourteen granted patents and several other patent filings related to microsystems, nanotechnologies, sensors and their applications.

New generation of Li-on accumulators

Alexander Filippov, CJSC PLASMAS

14:15

CJSC Plasmas offers advanced anode materials based on carbon nanotube – silicon (Si) or carbon nanotube – silicon dioxide (SiO₂) nanocomposites for high capacity lithium-ion accumulators. The advanced anode materials are able to reach the following parameters:

- Specific capacity of an anode material not less than 2000 mAh/g.
- Specific energy more than 150 W-hour/kg.
- Volume specific energy more than 400 W-hour/l.

The parameters offered by the advanced anode materials therefore exceed the best commercial materials by a factor of 5–10 with a cost that is competitive with the materials available in the market for lithium-ion accumulators at mass production.

The possible application areas for the materials are:

- Mobile systems
- Medical devices

- Smart cards
- Electronic paper
- Automobile electronic systems
- Aviation
- Space electronic systems

The company possesses significant scientific and technological expertise with a sophisticated lab for the manufacture and plasma-chemical treatment of nanomaterials. Also the mass production of advanced anode materials for lithium-ion accumulators is possible.

The technology is based on plasma-chemical treatment of the surfaces in high-frequency plasmas of various gases. This treatment allows the formation of series of functional

coatings on the surfaces that are used as electrodes in lithium-ion accumulators. Also the formation of ordered nanocomposite materials with controllable properties is the result of the plasma-chemical technology.

CJSC Plasmas is looking for cooperation in the manufacture of these advanced anode materials. The cooperation can be initiated with a short project to study the characteristics and potential of the material and it should continue to the direction of patent sale or license agreement or to the arrangement of joint industrial production of advanced anode materials for lithium-ion accumulators. The company holds relevant patents for technology, material and devices.

14:30

Picosun – The ALD Powerhouse

Juhana Kostamo, Picosun



PICOSUN HAS WHAT OTHERS DO NOT HAVE: Dr Tuomo Suntola invented and patented the method of ALD (Atomic Layer Deposition) in 1975. Today, Dr Suntola is a member of the board of directors of Picosun extending the arch of Picosun's ALD experience further than that of any other company.

Combined, Picosun's people possess well over 200 years of first-hand experience with ALD. This, too, is without equal. Picosun's people have been involved in the creation of over 100 patents covering different aspects of the science and technique of ALD. Picosun's ancestry in ALD is unique.

Picosun aspires to be the leading designer and manufacturer of ALD systems in the world. More and more key customers from around the globe are buying into our exclusive club

of Picosun Partners strengthening our market position and verifying the perception of Picosun as a leading ALD actor with the best systems solutions on offer.

PICOSUN HAS ALREADY SOLVED THE PROBLEM: Usually, what can be accomplished within the confines of top notch research chambers does not translate into production use without extensive and, all too often, painstakingly expensive and time consuming processes filling the technology gap between the practice of theory and the reality of large scale production.

Picosun has solved this fundamental problem for its customers. The basic design of Picosun's SUNALE™ ALD systems has uniquely been built in a way which allows the scaling

up of both the hardware and software directly from research to production. Enlarging the size of substrates, changing a method based on handling a single wafer to a process of producing defect-free batches, multiplying capacity by linking a number of production reactors to platforms or robotic handlers can all be done with minimum schedule requirements and without losing any of the key parameters.



PICOSUN'S ANCESTRY IN ALD IS UNIQUE

Mr. Juhana Kostamo is the managing director of Picosun.

Development and production of analytical instruments

Maxim Slyadnev, Lumex Ltd.

14:45

Lumex Ltd. R&D and Production Company was founded in October 1991 as a joint-stock company with limited liability by a team of research staff members of the world-famous Vavilov State Optical Institute and the Positron Corporation. Presently, the Lumex key personnel are scientists, engineers, and designers who came from St. Petersburg State University, Technological Institute, State Institute of Applied Chemistry, and from other leading R&D institutions of Russian Academy of Sciences and industrial companies. To date, there are about 400 research, production and administration staff members on the Lumex payroll.

Lumex Ltd. develops and distributes throughout the world a wide range of laboratory and automatic analytical instruments of more than 20 types of its proprietary design for scientific and industrial research, process and environmental control, providing its high-tech analytical instruments with a comprehensive methodological support and extensive training of customer's personnel.

The products include

- Atomic Absorption Spectrometry
- Capillary electrophoresis
- Laser particle analyzer
- Microwave sample digestion
- IR Spectrometry
- Luminescent and absorption photometric analysis
- Automatic water flow analyzers
- PCR Analyzers

Carbon nanotube and NanoBud™ thin films: Cost-effective solutions for electronics, energy and beyond

David Brown, Canatu



Canatu produces and sells a new class of versatile carbon nanomaterial based optical and electronic thin film components supplying the energy and electronics sectors. The estimated total market size for these products is currently \$70 billion and will be above \$100 billion by 2015. Our introductory market is growing at more than 100% per year. In 2011, Canatu plans revenues from sales and licensing of 7 M€ growing to more than 70 M€ by 2014.

Our introductory products are flexible, conductive films for transparent electrodes in e-paper displays and touch screens, replacing expensive and limited performance ITO. Canatu will later provide transparent electrodes in OLEDs and solar cells and will progressively move up the value chain to provide full e-paper, touch screen, display, IC and photovoltaic modules.

Canatu has developed a novel carbon nanomaterial material, NanoBuds™, and a new way to directly and cheaply roll-to-roll print high value NanoBuds™ components (e.g. transparent electrodes, connectors, resistors, transistors, supercapacitors, photovoltaics, field emitters and saturable absorbers). These improve the performance and reduce the cost of existing devices, reduce their environmental footprint and enable the next generation of flexible and transparent products.

Canatu currently has the basic synthesis and deposition capacity to produce 1 million mobile touch screens per year and is currently developing capabilities for low cost mass production.

Our team includes former Nokia CTO, Yrjö Neuvo and highly respected entrepreneurs and nanotechnologists including Ari Ahola and Prof. Esko Kauppinen.

Canatu has 45 patents and applications in 11 families covering -CNT and NanoBud™ production separation, deposition and component production methods -Nanomaterials characterization methods -NanoBud™ based electronic, energy and optical devices and -CNT and NanoBud™ based user interfaces

Canatu is planning to raise 12 M€ in winter 2009 – 10 to be used predominantly to fund production facilities to supply our first projected customers.



Dr. David Brown is the CEO of Canatu. Before becoming CEO of Canatu, Dr. Brown was the CEO of Teicos Pharma, Particle Stream Technologies and StreamWise Finland,

a Senior Research Scientist at the Helsinki University of Technology, Department of Physics, a Fulbright Fellow at Tartu University, Department of Physics and an science and engineering consultant to companies and research institutes worldwide. He is a leading expert in the modeling, design and scaling of synthesis reactors and deposition and characterization systems. He has a PhD in Environmental Engineering from the University of Cincinnati and a B.S. in Aerospace Engineering from the University of Michigan.

Implementation of technology of fluoropolymer coating of details made of aluminum alloy AK4 in manufacturing of gas pressure/flow regulators

Kristina Ivanenko, KRASS



15:15

In the course of the project we developed the technologies for the creation of nanostructured fluoropolymer blocking layer in gas duct of the details made of aluminum alloy AK4.

Application of nanotechnologies for aluminum details protection renders possible a good adhesion of the fluoropolymer and provides the required protection of the detail surface under long-term performance in the aggressive gases (e.g. in oxygen under the pressure of up to 300 atm).

The results of the project can be implemented in gas regulating and gas-flame equipment, check valves, valves, instrument engi-

neering, sensors, in medical devices and instruments and in the automobile industry.

The group of companies "KRASS", the leading Russian gas-regulators producer, is presented in the report. The plan of modernization of existing production for manufacturing of high-technology products with the implementation of fluoropolymer coating of aluminum alloys is presented. Subsequent promotion of the products on the world market will follow.

Ms. Kristina Ivanenko is the import/export manager of KRASS.

Electronic and optical materials enabling next generation semiconductor devices

Thomas Gädda, Silecs



15:30

Silecs Oy is an innovator of specialty chemicals and enabling materials used in the microelectronics industry, particularly in advanced semiconductor packaging technologies, flat panel displays, semiconductor logic and memory devices, digital cameras, solar cells and LED lighting applications. Founded in 2001, Silecs has its headquarters in Espoo, Finland, together with the company's innovation center, which encompasses research, development and a world-class ISO 9001 and ISO 14000 certified manufacturing operation. Silecs also provides local and regional customer support through

an extensive global network. Silecs Oy's subsidiaries are located in Singapore and Hong Kong.

Silecs' customers are world leaders in flash memory manufacturing, CMOS image sensors and semiconductor foundries. The company develops optimized, environmental electronic material solutions that help customers averting vast capital expenditures in their efforts to introduce new products. The proprietary, innovative polymer technology based on siloxanes offers tailored solutions to problems customers are facing. In addition to recent customer

additions on CMOS image sensor and classic SOG (Spin-On-Glass) applications, our revolutionary technologies now allow advanced chip packaging at ultra-low curing temperatures and improved solar cell panel performance.

The company's SC platform for CMOS image sensors includes technology leading SC300, SC400 and SC800 materials possessing high indexes of refraction, and the low refractive index microlens overcoat material SC500. These are fully commercialized and ready for shipment to qualified image sensor manufacturers. Cooperation between Silecs and IBM, in an effort to optimize the performance

of Image Sensors with a pixel size less than 2.2 μ m, has shown the beneficial impact of SC400 and the nanoparticle containing SC800 light guide materials on quantum efficiency and light response angle.

Dr. Thomas Gädda has been involved in the development of materials for various applications in micro- and optoelectronic industry at Silecs. Dr. Gädda manages the development effort of nanoparticle containing materials with ultra high indexes of refraction. He has an MS from the Helsinki University of Technology and a PhD from the University of Southern California.

15:45

MEMS/NEMS sensors fabrication in Moscow Institute of Electronic Technology (MIET), Zelenograd: opportunities and prospects Nikolay Dyuzhev, Science-technology center "nano- and microsystem technique"



In the given report we summarize the information about new pilot MEMS/NEMS devices factory created in MIET. Consider technology is optimized for microelectromechanical sensors fabrication on 150 mm wafer. Technological equipment, opportunities and prospects are described.



Prof. Dyuzhev is the chief of Science-technology center "Nano- and Microsystem technique" in Moscow Institute of Electronic Technology (MIET). He

graduated from Moscow Institute of Electronic Technology in 1975 and did his post-graduate studies in Moscow Institute of Physics and Technology. He has been a candidate in Physical and Mathematical since 1986.

Prof. Dyuzhev's scientific interests are:

- Vacuum microelectronics
- MEMS/NEMS sensors
- Design&Technology

Session IV: Micronova and Otaniemi Nano research facilities

16:30

MICRONOVA
Centre for Micro and Nanotechnology

Welcoming words & introduction to Micronova facilities
V.-M. Airaksinen, TKK/Micronova

Micronova is a joint research centre of the Technical Research Centre of Finland (VTT) and Helsinki University of Technology (TKK). Micronova's cleanrooms have the largest installed base of processing equipment for micro- and nanofabrication in Northern Europe. The facilities are used for the development of silicon and III-V semiconductor based devices for microsystems, microelectronics, nanodevices and photonics.

Micronova is one of Finland's National Research Infrastructures and operates on the basis of open access. The main users of the facility include research teams from VTT, TKK, other universities and a number of companies. Micronova's activities include fundamental research on nanoscale physics and new materials, development of new devices, prototyping and even small scale production. Close cooperation with industry is an essential part of the work at Micronova. The cleanrooms are also used for teaching and researcher training.

The infrastructure offers following processing capabilities:

- Nanofabrication, including electron beam and nanoimprint lithography and focused electron/ion beam processing.
- Key microfabrication techniques such as deep dry etching, wafer bonding, CMP, ion implantation.
- Advanced deposition techniques, including atomic layer deposition of oxides and nitrides and epitaxy of compound semiconductors and metals.
- Fabrication lines for microelectromechanical (MEMS) devices and microsystems.
- Integration of MEMS and BiCMOS devices.
- Packaging and testing of functioning devices.

16:45

VTT Nano research SVP Anne Ritschkoff, VTT



VTT functional and nanomaterial research creates expertise and technical solutions for designing, characterizing and applying functional & nanomaterials in various application areas. As enabling, cross-application technologies, the focus is not on single applications, but on few core competencies and key in-house technologies for multi-technological use. VTT's target application areas enabling nano- and functional materials include sustainable energy, functional coatings, light-weight and high-performance composites. The scientific research targets focus on recyclable and renewable nanocomposites and application oriented biomimetic approaches.



Prof., PhD. Anne-Christine Ritschkoff has worked at VTT since 1987. She is heading applied materials research as Research Director. Her area of responsibility covers materials research on nanotechnology, functional material technology and material technology in biorefineries. Her research career includes activities in biobased materials (fibres and nanocellulose), nanomaterials in functional coatings and surface modification. She has over 100 scientific publications and several patents.

17:00

Nano House and Nanomicroscopy center Professor Janne Ruokolainen, TKK



The new Nanomicroscopy Center is one of the largest microscopy clusters in Europe. The center infrastructure consists of various high resolution microscopy apparatus for soft, hard and

biomaterial characterization - including ultra-high-resolution sub-ångstrom transmission electron microscope, liquid helium cryo-TEM, scan-

ning electron microscope and various scanning probe microscopes. The building has been designed to provide very stable operating environment with minimal external disturbances and therefore 1 Å resolution can be easily achieved. I will also discuss briefly about some material science applications where these instruments can be used.

Prof., Dr. Janne Ruokolainen is the Director of the Nanomicroscopy center.

17:15



Reflections by the Russian Delegation Oleg Ivanov, RUSNANO

Mr. Ivanov is the Head of European Division in the Russian Corporation of Nanotechnologies, RUSNANO

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Russian Corporation of Nanotechnologies invites you to take part in the Third Nanotechnology International Forum and Exhibition in Moscow, November 1–3, 2010

For more information please visit www.rusnanoforum.com



