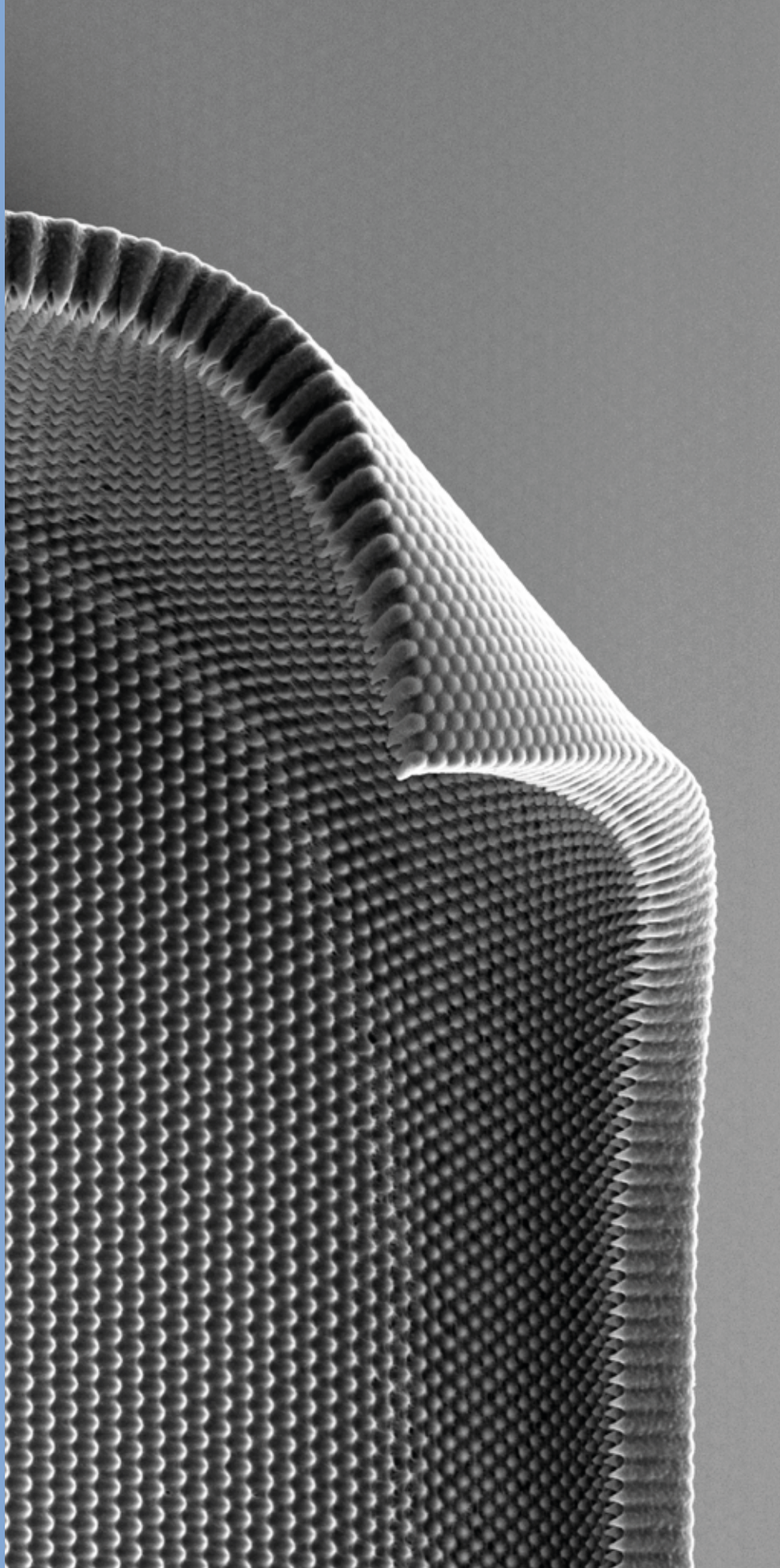
Annual Report Nano@NTNU 2017



NTNU
Norwegian University of
Science and Technology

Nano@NTNU 2017


Photo: IESE

This is an exciting time to be the Director of Nano@NTNU. Our strategic initiative has grown to represent more than a hundred faculty members from over twenty countries, working in numerous areas of nanotechnology, nanoscience, and functional materials. This marks a huge growth in numbers: ten years ago, the number of faculty members in the nano field was just forty. In the same period, the combined number of PhD students and post docs has doubled to its present value of 262. Last year we graduated forty PhD students in nanoscience, about half of whom were active users of the NanoLab. We are fast approaching our long-term goal of producing an average of one new PhD dissertation every week. Our research volume continues to grow, too. The number of publications this year was 276 of which fifty included work performed in the NanoLab. A list of publications may be found on our webpage. In 2017, there were 222 ongoing nano-related projects at NTNU, corresponding to a total budget of 1.55 BNOK and an annual budget of 185 MNOK. I am confident that the numbers will continue to grow from here!

2017 has been a busy year for the NanoLab internationally. In May we hosted the first Nordic NanoLab User Meeting (NNUM2017) in Trondheim. And, together with our Nordic and European partners, we arranged Europe´s first cleanroom management conference (ENRIS2017) in Trondheim. NanoLab has also been working closely with the European Strategy Forum on Research Infrastructures to make sure the needs of the Nordic countries are fully taken into account in their future planning.

In 2018, the strategic effort Nano@NTNU will change its name to NTNU Nano. Along with this a new scientific director, John de Mello, has been appointed to support and coordinate scientific research in nanotechnology across the university. As the Director of NTNU NanoLab, I look forward to working closely with John to ensure that the coming years are even more productive for NTNU Nano than the one that has just passed.

Kay Gastinger
Director Nano@NTNU

New director of NTNU Nano in 2018

On January 1st 2018, Prof John de Mello will be joining NTNU as the scientific director of our strategic initiative, NTNU Nano. John will be joining us from Imperial College London, where he has been a professor of nanomaterials since 2011. He has also held an adjunct position in the Department of Chemistry here at NTNU for the past three years, working closely with colleagues in the Centre for Organic Electronic Materials. A recipient of the Royal Society's Brian Mercer Award for Innovation in Nanotechnology, John brings to NTNU a broad activity in nanoscience that ideally complements our existing research portfolio, and we are delighted to welcome him to Trondheim!

Front page: The image shows SU-8 nano pillars exposed using Elionix EBL system. Photo: Jakob Vinje/NTNU NanoLab.

NORWEGIAN MICRO- AND NANOFABRICATION FACILITY
NorFab

The Norwegian Micro- and Nanofabrication Facility, **NorFab** was established in 2010 by the Research Council of Norway (RCN) as a national infrastructure with four partners; NTNU, University of Oslo, SINTEF Digital - Microsystems and Sensors and University College of Southeast Norway. In 2016, the RCN granted NorFab a new project period (NorFabII), which will run from 2016 until 2019.

On May 8 – 9 2017 NorFab hosted the first European Nanofabrication Research Infrastructure Symposium – ENRIS 2017, at NTNU. The meeting gathered 122 leaders and experts from 38 clean-room infrastructures and 13 companies, from 20 countries. The Nordic Nanolab User Meeting, NNUM2017 also took place at NTNU on May 9 – 10, starting after lunch in the same venue as ENRIS. This meeting was organized by the Nordic Nanolab Network (NNN) and was the third user meeting on a Nordic level. Altogether, 263 people attended NNUM2017, which was supported by the Research Council of Norway. The NNN has also had two meetings at the leader group level to exchange best practice experiences.

In addition, the Nordic Nanolab Expert Network (NNEN) constitutes a forum for the exchange of information about micro- and nanofabrication between engineers. In 2017, NNEN organized four workshops focusing on thin films, dry etching, lithography and facility operation issues. The workshops had 15-20 participants from 19 cleanrooms in the Nordic countries. Inbetween meetings the experts exchange experiences in an online forum.

Website: **www.norfab.no**

NanoNetwork

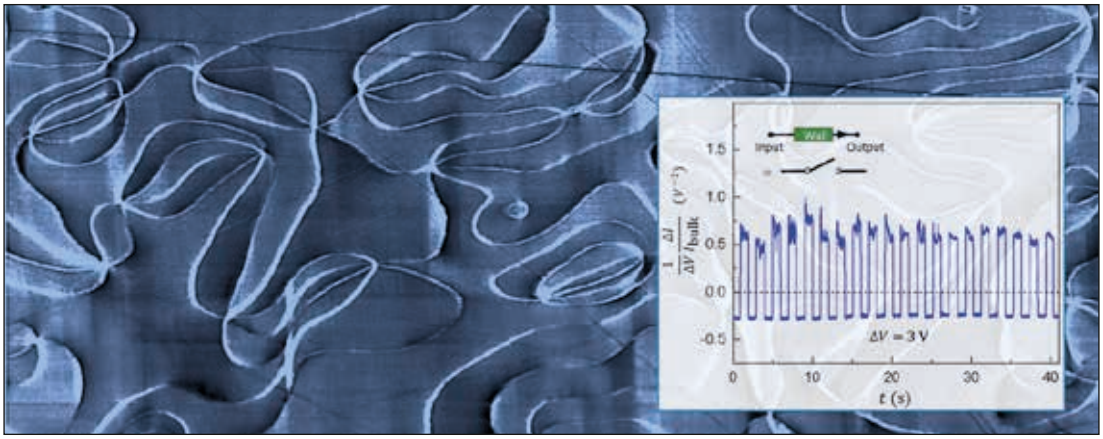
The Norwegian PhD Network on Nanotechnology for Microsystems was established in 2009, with the objective to coordinate, integrate, and strengthen PhD programs in the field of nanotechnology and microsystems in Norway. The partner institutions were NTNU, University of Oslo, University of Bergen, the University College of Southeast Norway, and SINTEF Digital - Microsystems and Sensor until December 1st, when University of Tromsø also joined the network. Funding is provided by the Research Council of Norway, Division of Science, Program for National Graduate Schools.

In 2017, the Network offered six PhD courses on compact format and provided travel support for the candidates to attend these courses. The network has allocated activity grants to 26 PhD candidates and travel support for 29 candidates to present their work at international conferences. Our 2017 annual workshop was held in Bergen, June 12th to 14th, gathering 78 participants.

Website: **www.nano-network.net**

Towards all-domain-wall nanoelectronics

Oxide interfaces exhibit a broad range of tunable phenomena beyond the bulk properties, including multiferroicity and superconductivity. Particularly intriguing are domain walls, i.e., a special type of interface that naturally occurs in materials with magnetic or electric order. Such walls can be generated, deleted or moved at will, holding great promise as active 2D systems for future nanoelectronics. An international team, led by Assoc. Prof. D. Meier at the Dept of Materials Sciences and Engineering, has emulated the behavior of digital switches based on ferroelectric walls in $ErMnO_3$. The work has brought us an important step closer to electronic nano-components such as transistors and gates, foreshadowing the possibility to design elementary digital devices for all-domain-wall circuitry.

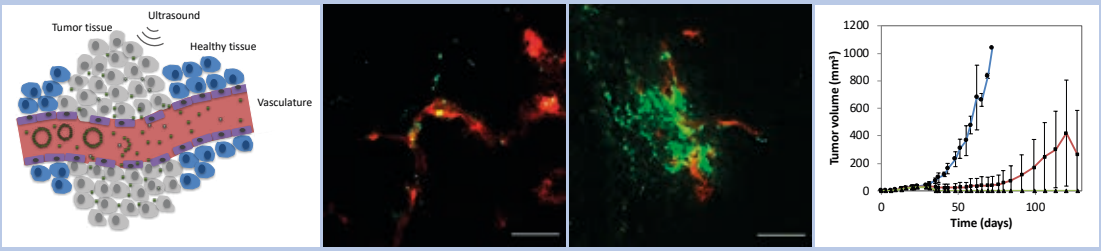


Conductivity map showing ferroelectric domain walls in ErMnO3. The walls have a structural width of less than one nanometer and controllable electronic transport properties (inset), acting as atomic-scale digital switches.

Ref.: J. Mundy, J. Schaab, Y. Kumagai, A. Cano, M. Stengel, I. P. Krug, D. M. Gottlob, H. Doganay, M. E. Holtz, R. Held, Z. Yan, E. Bourret, C. M. Schneider, D. G. Schlom, D. A. Muller, R. Ramesh, N. A. Spaldin, and D. Meier, *Nature Materials* 16, (2017) 622
Contacts: Dennis Meier, Dept of Materials Science and Engineering, NTNU.

Nanoparticle-microbubbles for cancer treatment

Cancer treatment with chemotherapy is limited by inadequate delivery to the tumor and severe side-effects due to accumulation in healthy tissues. Encapsulation of drugs in nanoparticles can enable more targeted delivery, improved efficacy and reduced toxicity. However, delivery of nanoparticles is often insufficient due to various biological barriers in the tumor. Ultrasound in combination with microbubbles has emerged as a promising method to enhance delivery of nanomedicines. A team led by Prof. C. Davies at the Dept. of Physics has investigated a multifunctional drug delivery system consisting of microbubbles stabilized by nanoparticles. The biomechanical effects from the oscillating microbubbles enhance permeability of the vascular wall, and improve uptake and distribution of the nanoparticles in the tumor, resulting in enhanced therapeutic efficacy.

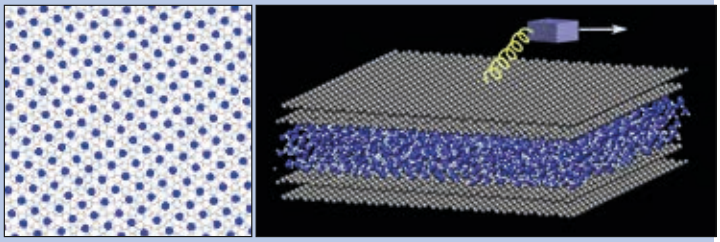


Schematic illustration of drug delivery with nanoparticle-stabilized microbubbles and ultrasound (left). Two confocal microscopy images (middle) of tumor vasculature (red) and nanoparticles (green) without (A) and with ultrasound (B), demonstrating increased uptake of nanoparticles after ultrasound. Tumor growth with time (right). Tumors that did not receive any treatment grew continuously (blue). Mice that were treated with microbubbles with drug showed reduced growth (red), but after some weeks the tumors grew back. With the use of ultrasound in addition (green), the tumors disappeared and did not come back for the duration of the experiment, 100 days after treatment. Treatments were done on day 21 and 29.

Ref: Snipstad S, Berg S, Mørch ÝA, Bjørkøy A, Sulheim E, Hansen R, Grimstad I, van Wamel A, Maaland AF, Torp SH, Davies C de L., Ultrasound in Medicine and Biology *43 (2017) 2651*
Contact: Catharina de Lange Davies, Dept of Physics, NTNU.

How square ice helps lubrication

Graphite powder has been used as a solid lubricant or additive to liquid lubricants for over a century. It is far more effective under humid conditions than in vacuum or dry air, but this effect is not yet understood. A team led by Assoc. Prof. A. de Wijn at the Dept. of Mechanical and Industrial Engineering has used atomistic molecular-dynamics simulations to investigate water confined between graphene sheets. Their results demonstrate that, under the right sliding conditions, square ice can form in a nano-scale contact asperity, and that it is similar to cubic ice VII and ice X. By simulating sliding of atomically flat graphite on the square ice, they found extremely low friction due to structural superlubricity. They suggest that the ice observed in AFM experiments of friction on wet graphite is of this type.

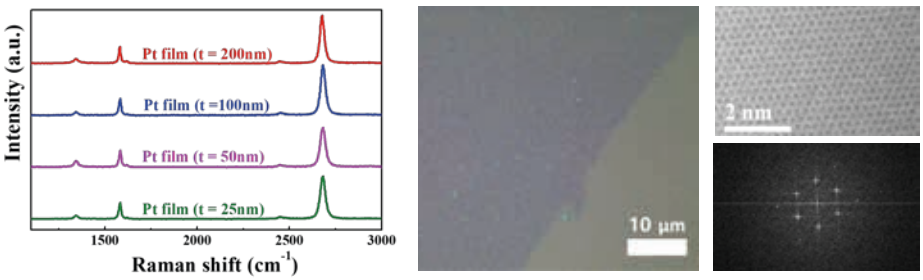


Left: A top view of the bottom layer of the ice and the first graphene layer beneath it. Right: A simulation of water between sheets of graphene.

Ref: A.S. de Wijn, *et al.*, *Physical Review* B 96 (2017) 1.

Graphene growth on Pt film

One big issue in chemical vapor deposition (CVD) growth of graphene using Cu as a metal catalyst is Cu contamination during its growth and transfer, which poses a serious challenge in its integration with standard Si integrated circuit platforms. One can avoid this contamination issue in principle by using Pt instead of Cu. A group led by Prof. H. Weman, Dept of Electronic Systems has shown a successful CVD growth of homogeneous single layer graphene on high-temperature sputtered Pt films with a thickness down to 25 nm. The method can be readily extended to wafer-scale graphene growth.

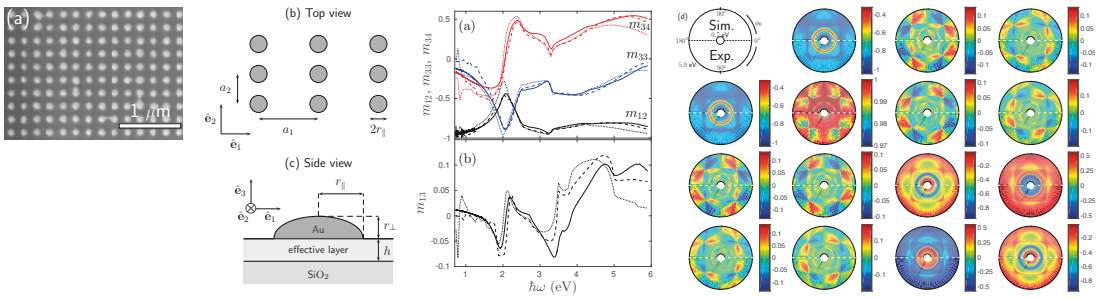


Ref: J. Nam *et al* *Carbon* 111 (2017) 733

Raman spectra of graphene grown on Pt films with different thickness (left), Optical microscope image of graphene grown on 25 nm thick Pt film (middle), HRTEM (top) and FFT (bottom) images of graphene (right).

Critical dimension metrology of a plasmonic photonic crystal based on Mueller Matrix Ellipsometry and the reduced Rayleigh equation

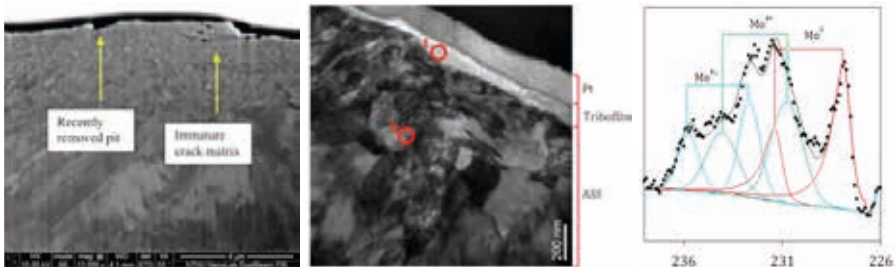
New functionalities can be achieved by using artificially designed optical surfaces for sensing and control of light. The building blocks of such surfaces can e.g. be based on arrays of plasmonic particles. The change in the polarization state of light in such surfaces is strongly dependent on the accuracy of the nano-manufacturing process, which requires accurate electromagnetic modelling. A group at the Dept. of Physics has studied the numerical extraction of critical dimension parameters using the reduced Rayleigh equation. The samples consisted of arrays of Au plasmonic hemispheres manufactured at NTNU NanoLab by direct Focused Ion Beam-milling of a thin Au film deposited on glass. Below are the measured (lower halfs) and fitted (upper halfs) 4x4 Mueller Matrix (MM) from such an array, and selected MM elements with photon energy.



Ref: J. P. Banon *et al.*, *Opt. Lett.* 42 (2017) 2631-2634. Contact: M. Kildemo, Dept. of Physics, NTNU.

Advanced characterization methods in investigating tribological systems

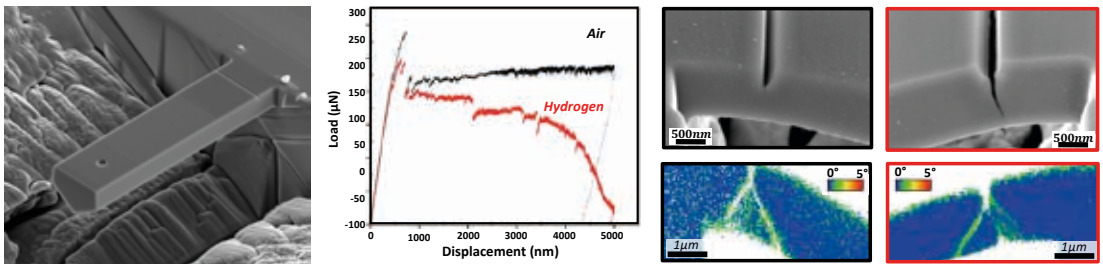
Nanoscale characterization and sample preparation methods have made a great contribution in the field of tribology. A team led by Prof. N. Espallargas at the Dept. of Mechanical and Industrial Engineering has used focused ion beam (FIB) milling of surfaces to investigate subsurfaces with minimized changes to the structure. Their work has led to an understanding of recrystallization, crack formation and propagation as well as possible scenarios for material failure. Moreover, cutting nano-sized specimens made it possible to prepare TEM samples at the point of interest and to examine possible oxide layer formation in tribocorrosion. Chemo-mechanical phenomena in complex systems such as tribocorrosion-fatigue were also studied by chemical characterization methods such as X-ray Photoelectron Spectroscopy and Auger Electron Spectroscopy. This work was carried out to investigate wear, corrosion and fatigue of stainless steels.



Ref: Zavieh A.H. and Espallargas N., *Journal of Tribology International* (2017) 138

In situ electrochemical microcantilever bending test: A new insight into hydrogen-enhanced cracking

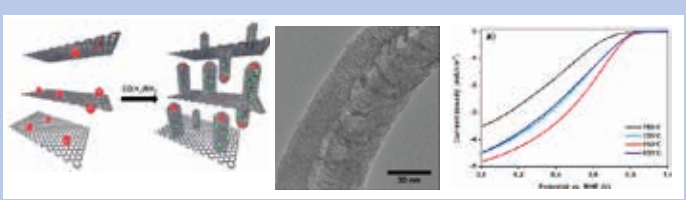
Hydrogen-induced degradation of metals has been a severe problem in different industrial fields including the petrochemical and oil-and-gas industries. Micro- and nano-mechanical tests can provide insight into the way hydrogen interacts with different microstructural features of metals. A team led by Prof. Barnoush at the Dept of Mechanical and Industrial Engineering has prepared microcantilevers in the absence and presence of hydrogen using focused ion beam milling. Testing the cantilivers using an electrochemical microcantilever bending setup in a nanoindenter revealed geometric dislocations when hydrogen was present.



Ref: Hajilou, T. et al *Scripta Materialia* (2017) 17, Contact: Afrooz Baroush, Dept of Mechanical and Industrial Engineering, NTNU

Nitrogen-doped carbon nanofibers for the oxygen reduction reaction: Importance of iron growth catalyst phase

A team led by Prof. M. Rønning from the Dept of Chemical Engineering has carried out an evaluation of oxygen reduction on nitrogen-doped carbon nanofibers (N-CNFs) using chemical vapor deposition to tune the properties of the N-CNFs. Analysis of the as-synthesized N-CNFs showed that the iron used as growth catalyst consists of iron carbides including Fe_7C_3, χ-Fe_5C_2 and θ-Fe_3C depending on the carbon activity of the synthesis feed. The best electrocatalytic activity and selectivity was achieved when the N-CNFs were grown from Hägg carbide, χ-Fe_5C_2. Controlling the iron phase of the growth catalysts was found to be essential for obtaining N-CNFs with a high active site density for the oxygen reduction reaction.



N-doped carbon nanofibres: Synthesis, microstructure and ORR activity

Ref.: M.E. Melandsø Buan, et al. *ChemCatChem*, 9 (2017) 1663

Grey Goo Symposium, 07.02.2017

The annual Grey Goo Symposium is a meeting place for companies and students enrolled in the master program in nanotechnology at NTNU, Trondheim. The aim of the symposium is to promote exchange of knowledge and ideas, and to prepare the ground for an increased number of collaborative master projects with industry. Both students and industry representatives were given the opportunity to present their expertise, and hold informal discussions during the breaks. Around 100 students from NTNU and six guest students from Denmark participated together with representatives from Norwegian companies. The symposium was organised by Timini, the association of the nanotechnology students, and was sponsored by Nano@NTNU.

First European Nanofabrication Research Infrastructure Symposium, ENRIS, 8-9.05.2017

The first European conference on cleanroom operation, management and user training was hosed by NTNU in Trondheim. The meeting began with an organ concert in the Nidaros Cathedral, hosted by Trondheim municipality, followed by a welcome reception. The following one-and-a-half day program included presentations on the following topics: National infrastructures for nanostructuring, sustainability, laboratory information systems, financing models and pricing, efficiency and community interaction/innovation. In addition, guided visits to NTNU NanoLab were arranged. Altogether, 122 leaders and experts representing 38 cleanroom infrastructures and 13 companies, from 20 countries, participated at the meeting. ENRIS 2017 was organized by the Nordic Nanolab Network in cooperation with EuroNanoLab.


Photo: Per Henning/NTNU

Participants at the first European Nanofabrication Research Infrastructure Symposium, ENRIS2017.

Nordic NanoLab User Meeting, NNUM2017, 9-10.05.2017

The Nordic Nanolab User Meeting, NNUM2017 started after lunch in the same venue as ENRIS. The meeting was organized by the Nordic Nanolab Network (NNN) and constituted the third user meeting on a Nordic level.

The aim of NNUM is to offer a meeting place for PhD-students, post docs, researchers and engineers working in the field of nanostructuring and characterization. These meetings address experimental issues through technical tutorials covering the central disciplines of nanofabrication: etching techniques, thin film technologies, lithography and characterization. As additional inspiration, four invited speakers gave presentations of their work. The participants also had the opportunity to present their own research at a poster session. For the first time, a poster prize of 5000 NOK in travel support to attend an international conference was awarded. The prize was given to Einar Digernes from NTNU for the poster: "Complex oxide samples for scanning tunnelling X-ray microscopy". Finally, NTNU NanoLab and NorTEM offered guided tours. Altogether 263 people attended NNUM2017, which was supported by the Research Council of Norway.

Nano@NTNU Symposium, 6-7.12.2017

The event took place at NTNU Campus Kalvskinnet in Trondheim and gathered 123 participants.

The objective of the symposium was to feature nanorelated research at NTNU in a cross-disciplinary forum. The scientific program consisted of 29 oral presentations, including one invited plenary speaker, Prof. Bengt Svensson from the University of Oslo. The meeting also included a poster session exhibiting 23 posters. The winners of this year's prizes for the best oral presentation and best poster were Dingding Ren (best oral presentation) and Yun Deng (best poster). The symposium also included a social dinner.


Photo: Ida Nodeland, NTNU

Yun Deng and Dingding Ren.

NTNU NanoLab

2017 brought a number of new instruments and techniques into the cleanroom. The Heidelberg MLA150 maskless aligner (MLA) was installed, and for many users this has changed the lithography workflow substantially: The system allows users to rapidly prototype and test new ideas, without the cost and long delivery times associated with ordering chrome masks. Resolutions down to 1 µm can be obtained with relative ease. Higher resolution structures can be patterned in the electron beam lithography system (EBL) and then mixed and matched with patterning in MLA for faster and more cost efficient processing.

Another new capability was added through the installation of an Atomic layer Deposition (ALD) system, which is capable of depositing conformal, pinhole-free and uniform films with atomic precision. Currently it is possible to deposit Al_2O_3, HfO_2, ZrO_2 and TiO_2. Other material systems such as $PtBaTiO_3$ and $SrTiO_3$ and others are under development.

An industrial grade dicing saw has been installed to replace our old saw, resulting in lower levels of particle contamination.

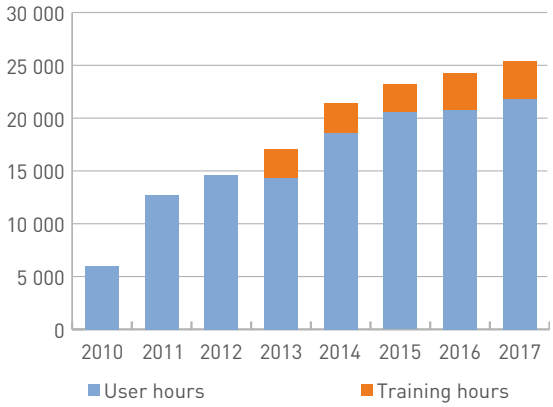
A highly requested Kammrath & Weiss sample transfer module is now available to move samples between the glovebox to the FIB in an inert atmosphere.

Our engineers also brought the thin-film and dry-etch instruments back into operation, following a tough period with extended equipment downtime on the dry etch systems in 2015/16. We will focus on improving the thin-film and dry etch capabilities and uptime through additional investments in the coming years.

In 2017 there were 336 active users of NTNU NanoLab, with an excess of 25000 hours booked throughout the year. Training new users to work safely and competently in the cleanroom is one of the main tasks for NanoLab's staff. There were 197 new users in the NanoLab in 2017, and over 1000 new instrument and area licenses were issued.

Looking forward to 2018, we will hire two additional engineers who will focus on thin film, dry etch and characterization. In addition, we aim to introduce an operator service that will allow researchers to outsource small projects to the cleanroom staff. With this expansion, we believe we will be well equipped to meet the needs of our cleanroom users for the foreseeable future.

User hours NTNU NanoLab



User hours by user category

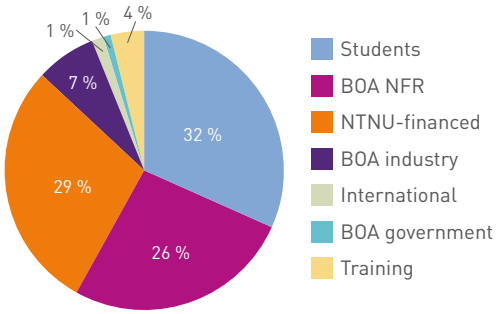


Photo: Geir Mogen, NTNU

Board of Nano@NTNU

- Prof. Anne Borg,dean of the Faculty of Natural Sciences, NTNU (head of the board) until 01.08.2017
- Prof. Øyvind Gregersen dean of the Faculty of Natural Sciences, NTNU (head of the board) from 01.08.2017
- Prof. Bjørn Gustafsson, dean of Faculty of Medicine and Health Sciences, NTNU
- Prof. Ingvald Strømmen, dean of the Faculty of Engineering, NTNU until 01.08.2017
- Olav Bolland, dean of the Faculty of Engineering, NTNU from 01.08.2017
- Prof. Geir Øien, dean of the Faculty of Information Technology and Electrical Engineering, NTNU.
- Dr. Ellen Dahler Tuset, Kongsberg Norspace AS, President

Skipnes Kommunikasjon Nordic ecolabel - printed matter Lisence no. 241 731

Dissertations

The following candidates obtained a PhD degree at NTNU in fields related to nanoscience,nanotechnology and functional materials in 2017. Highlighted candidates have carried out part of their work in NTNU NanoLab.

- **Lyubomir Ahtapodov,** ***Optical properties of III-V semiconductor nanowire structures***
- **Sindre Hove Bjørnøy,** ***Understanding crystallization in alginate-calcium phosphate composites***
- **Marthe Emelie Melansø Buan,** ***Nitrogen-doped Carbon Nanofibers for the Oxygen Reduction Reaction***
- **Xuemei Cheng,** ***Development and characterization of surface passivation materials on silicon wafers for solar cells***
- **Mads Christensen,** ***Fabrication of lead-free ferroelectric thin films based on $Bi_{0.5}Na_{0.5}TiO_3$ by aqueous chemical solutions deposition***
- **Antoine Robert Marie Dalod, In situ** ***synthesis of titania and titanium based organic-inorganic nanomaterials***
- Camilla Espedal, *Spin-Orbit-Induced Electronic Phenomena in Superconductors and Antiferromagnets*
- **Espen Fanavoll,** ***Microfluidic flow cells for the analysis of electrocatalytic reactions***
- Berit Glomstad, *Adsorption of phenanthrene to carbon nanotubes and its influence on phenanthrene bioavailability/ toxicity in aquatic organisms*
- **Yi Gong,** ***Core-shell structured microgels and their behavior at oil and water interface***
- Ingrid Hallsteinsen, *Geometrical lattice engineered oxide interfaces*
- Gabriel Heredia, *Novel hybrid membranes for post-combustion CO_2 capture*
- Ida Hjorth, *Catalysts for electrochemical conversion of CO_2 in aqueous solutions*
- Narjes Jafariesfad, *Nano-Enabled Cement System for Well Cementing*
- André Kapelrud, *Spin pumping, spin transfer, and spin Hall effects in magnetic insulator – normal metal systems*
- Elisa Magnanelli, *Understanding and Reducing the Entropy Production in Membrane Systems*
- Mehdi Mahmoodinia, *Electronic Structure, Stability, and Chemical Reactivity of Transition-Metal Catalysts Supported by Graphene Nanomaterials*
- Magnus Moreau, *Ab Initio Studies of Functional Oxides for Thin Film Applications*
- **Stanislav Polyakov,** ***Electronic and optical properties of doped Cu_2O and ZnS thin films***
- Masoud Ramezanzadehkoldeh, An experimental and numerical study of cortical bone at the macro- and nanoscale - evaluation of long term proton pump inhibitors treatment on bone properties
- **Dingding Ren,** ***Growth and Characterization of Self-Catalyzed GaAsSb Nanowires for Optoelectronic Applications***
- Stefan Rex, Electric and magnetic signatures of boundary states in topological insulators and superconductors
- **Jonas Myren Ribe,** ***Microfluidic devices for active and passive separation of submicron particles***
- **Mtabazi Geofrey Sahini,** ***Aspects related to the thermal and mechanical stability of oxygen permeable membranes***
- **Karen Nessler Seglem,** ***Development of membrane materials for a membrane contactor***
- Rocas Sazinas, *Stability and cation diffusion in $BaZrO_3$-based proton conducting solid state electrolytes*
- Marie Døvre Strømsheim, *Co(11-20) and Pd_3Au(100) single crystals as catalyst model systems*
- **Patrícia Moura Rosa,** ***Immunity-on-a-chip, Microfluidic Devices for Immunoengineering***
- Sandra Helen Skjærvø, *Structural and chemical stability of the hexagonal manganites*
- Eirik Skjønsfjell, *Quantitative 3D Imaging and Metrology Using Coherent X-ray Scattering*
- **Sofie Snipstad,** ***Ultrasound-mediated delivery of nanomedicine across biological barriers - for improved treatment of cancer and diseases in the brain***
- Seniz Ucar, *The effects of Alginate Additives on Calcium Phosphate Mineralization*
- Mladen Veletic, *On the neural Communication for Data Transmission in Nano-Networks*
- **Lu Wang,** ***Mn_3O_4 and Carbon-Based Cathode Materials for Magnesium Batteries***
- **Mao Wang,** ***Opto-electrical properties of a novel organic semiconductor: 6,13-dichloropentacene***
- **Susanne Wolf-Grosse,** ***Immunomodulatory effects of iron oxide nanoparticles in two human biological model systems***
- Haiyang Yu, *Modelling and Assessment of Hydrogen Embrittlement in Steels and Nickel Alloys*
- **Amin Hossein Zavieh,** ***Tribocorrosion-Fatigue (Multi-Degradation) of Stainless Steel – a fundamental approach in practical conditions***
- Dongdong Zhao, *Impurity segregation at defects in Al and Si - A theoretical DFT based study*
- Kai Zhao, *Small-Scale Plasticity under Hydrogen Environment*

Management

Director: Dr. Kay Gastinger
Coordinator: Dr. Hanna Gautun

Permanent Technical Staff

- Head of Laboratory Ida Noddeland
- Senior engineer Dr. Mathilde Barriet
- Senior engineer Mark Chiappa
- Senior engineer Ken Roger Ervik
- Senior engineer Svenn Ove Linde
- Senior engineer Trine Østlyng Hjertås
- Senior engineer Dr. Birgitte McDonagh
- Senior engineer Dr. Peter Köllensperger

Leader Group

- Director Kay Gastinger
- Prof. De Chen
- Prof. Roy Johnsen
- Associate Prof. Hilde Lea Lein
- Prof. Øyvind Halaas
- Prof. Pawel Sikorski
- Prof. Thomas Tybell
- Coordinator Hanna Gautun

Back, left: Svenn Ove Linde, Kay Gastinger, Hanna Gautun, Mark Chiappa, Ken Roger Ervik , Peter Köllensperger.
Front, left: Trine Hjertås, Mathilde Barriet, Ida Noddeland and Birgitte Hjelmeland McDonagh.