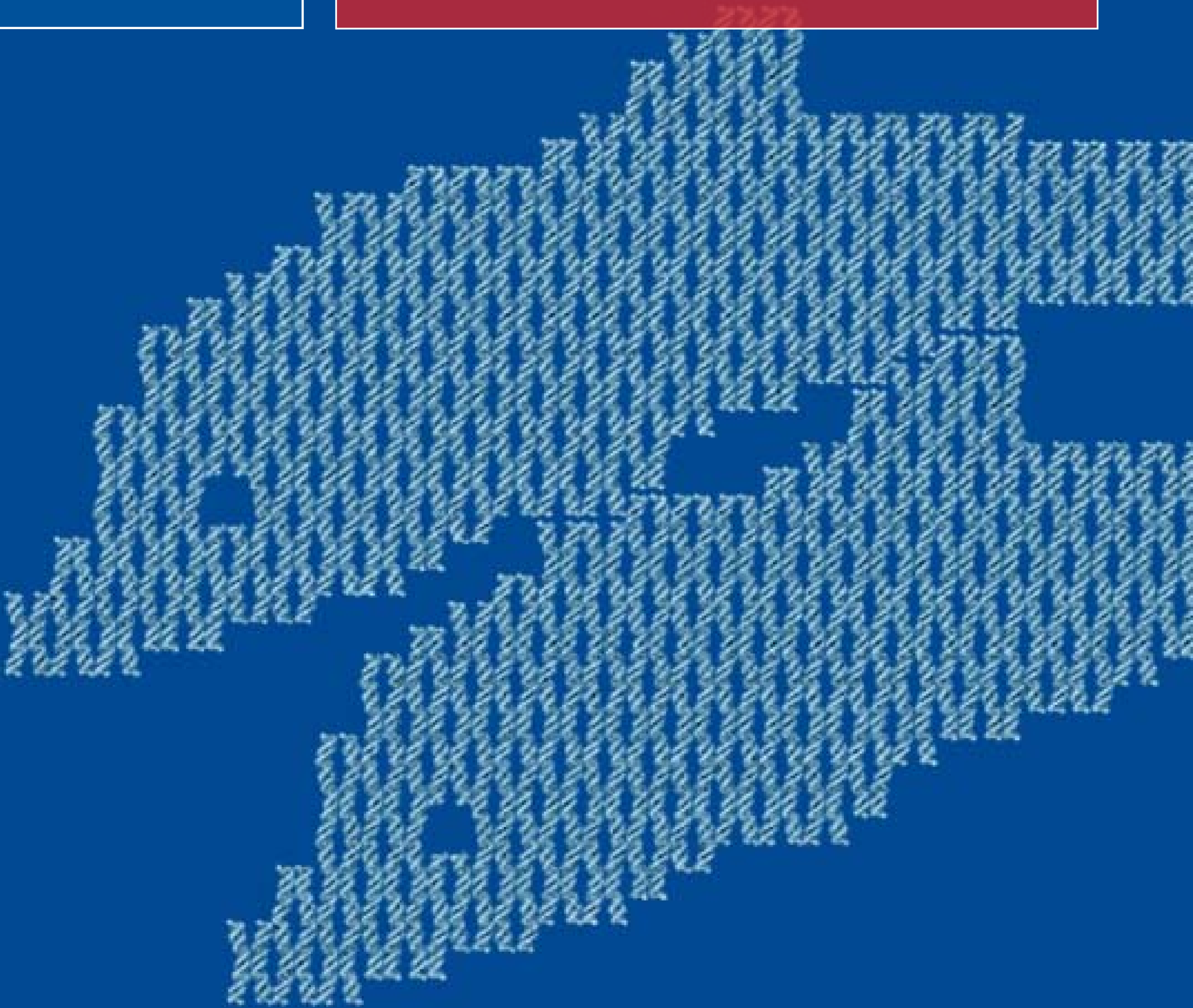
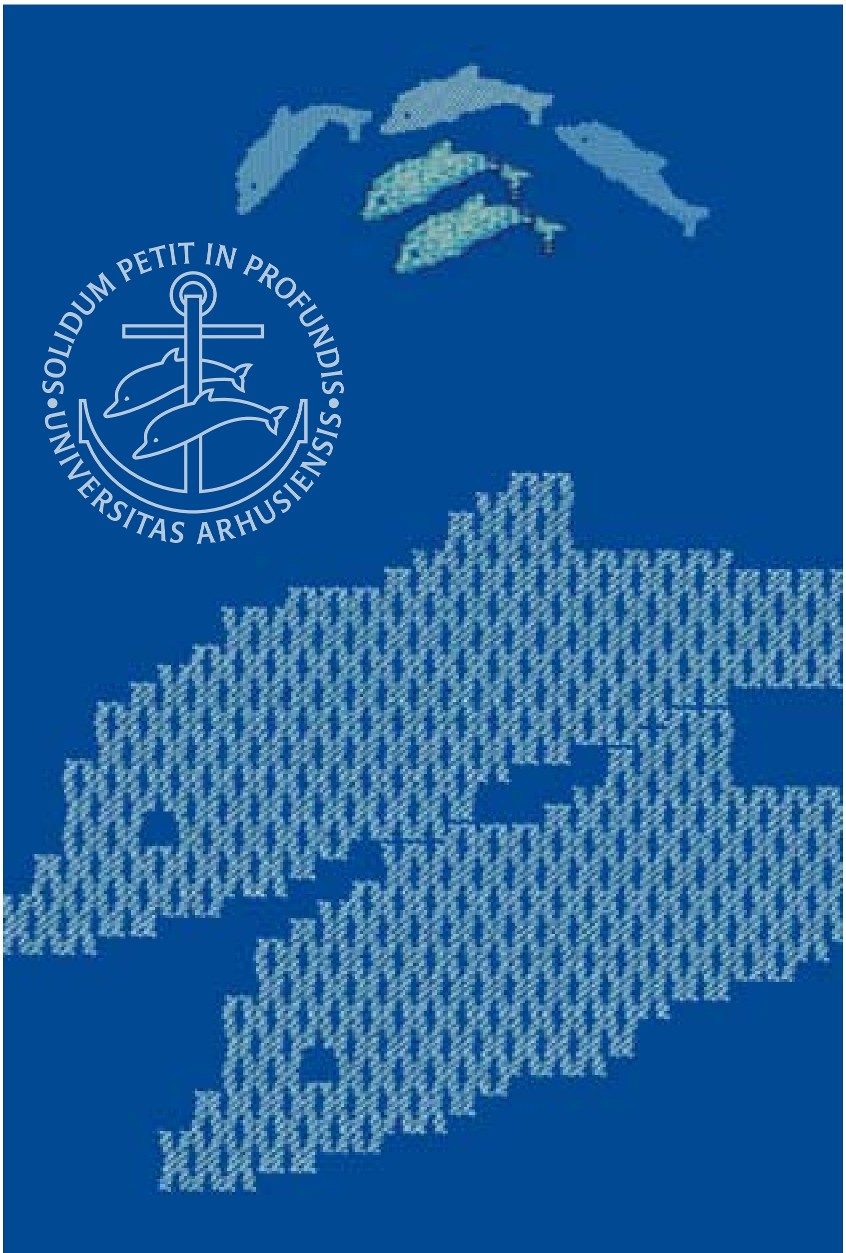
Annual Report 2008



iNANO - Interdisciplinary Nanoscience Center



Design and self-assembly of DNA nanostructures. The dolphins from the seal of Aarhus University were reconstructed at the nanoscale by the DNA origami method. The DNA dolphins measure 200 nm in length and have flexible tail regions as determined by Atomic Force Microscopy. The work was done in the context of the CDNA center.
Ebbe Sloth Andersen

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Trolle Rene Linderoth Chairman of Educational board
Signe Osbahr Scientific Coordinator
Tina Fredsted Scientific Coordinator
Leif Schauer Scientific Coordinator

Contact person:
Enette Berndt Knudsen Phone: +45 8942 3082

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iNANO – Interdisciplinary Nanoscience Center
The Faculty of Science, Aarhus University
Ny Munkegade 118, building 1521, DK-8000 Aarhus C, Denmark

www.inano.dk

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Contents

Message from the Director

I take great pleasure in presenting the Annual Report 2008 for iNANO, The Interdisciplinary Nanoscience Center at Aarhus University. The center has grown and matured tremendously since its inauguration in January 2002, but we keep our ambitions high and expect the positive development to continue in the years to come. With this annual report, we seek to provide the reader with an overview of the highlights of the iNANO 2008-activities.

By Flemming Besenbacher

At the end of 2008, 60 senior researchers, 45 post docs, and 123 PhD students were associated with iNANO. Our overall mission remains focused on three equally important pillars; education of outstanding, young scientists, research at the highest international level and focus on innovation and technology transfer to the industry. We continously pursue this mission with focus and dedication.

Education and other student issues

The nanoscience study programme had the same intake of about 50 new students in 2008 as the year before, which is contrasted by the fact that virtually all other science educations in Denmark experienced a massive drop in student intake in 2008. At the end of the year the total number of iNANO students enrolled in the Bachelor and Master's educations in nanoscience were 133 and 83, respectively.

With their strong interdisciplinary background our Master's students are attractive candidates for jobs in industry and other private companies or as scientists at various public research institutions. The students who have finished their Master's and chosen not to continue with a PhD study have found employment in a wide range of companies such as Lundbeck, Topotarget, NIL Technology, Odense Stålskibsværft, and FLSmidt. In the coming years, where substantially more students will graduate, we look forward to getting a clearer picture of the types of industry that will employ our candidates and thus, benefit from their interdisciplinary competences. Because the nanoscience study programme is still relatively new, it is important to constantly increase the general awareness of the education. Therefore, iNANO arranged a Matchmaking event in January 2008, where iNANO students could interact closely with representatives from Danish companies.

Our nanoscience students continue to impress and surprise with their enthusiasm and motivation. As a prominent example, I take pride in noting that three of our talented students Sofie Kastbjerg, Søren Porsgaard and Jakob Arendt Rasmussen won the Grundfos Challenge 2008 Innovation Award for their innovative suggestion for a new product Lab-on-a-tap, which is designed to provide consumers with safe and high-quality tap water. Another example is a group of our dynamic and dedicated nano-students who organized the second international, nanoscience student conference, INASCON, with participation of 100 students representing 8 different European countries. The students did an excellent job in arranging this conference which was a great success and thus, our students have once again promoted Danish education and research within nanoscience in the finest manner.

Research and funding

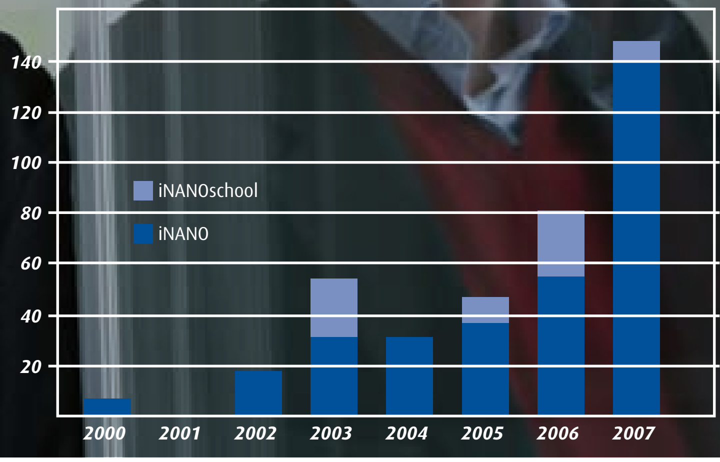
As evidenced by the examples in this annual report, iNANO scientists obtained excellent research results in 2008, which have been or will be published in high ranking, international peer-reviewed journals. A total number of 260 was published in 2008 by iNANO scientists, several in high profile journals like e.g. Science and Nature.

The full list of publications can be found at the end of this annual report together with a complete list of invited talks at international meetings and conferences. In addition, iNANO scientists continue to be recognized for their outstanding achievements. At this point, I will restrict myself to congratulate Professors Leif Østergaard and Poul Nissen, who both received the EliteForsk Award in 2008 in recognition of their outstanding contributions, and to Sigrid Weigelt who received Aarhus University Research Foundation PhD Prize.

iNANO scientists attracted a large number of research grants from various national and international sources in 2008. As can be seen from the figure above, the total funding secured by iNANO scientists and administered by the iNANO administration amounts to 104 million DKK, of which 21 million DKK are grants for our graduate school, iNANOschool. The primary national sources include: The Danish National Research Foundation, The Danish Council for Independent Research, The Danish Council for Strategic Research, The Danish Council for Technology and Innovation, Danish National Advanced Technology Foundation, and The Lundbeck Foundation. Among the grants obtained from international sources are several EU related grants, Marie Currie stipends and, in particular, two of the prestigious ERC grants.

Flemming Besenbacher
director

Figure showing funding obtained at iNANO from 2002 to 2008, both for iNANO in general and for iNANOschool.



Outreach initiatives

iNANO is involved in a large number of outreach activities, where the primary goals are to recruit new nanoscience students, to brand iNANO and Aarhus University and to enhance the general public's awareness of nanoscience and nanotechnology. The Matchmaking event mentioned above together with a new Nanoshow which was established during the autumn and described elsewhere in this report were among the new initiatives in 2008.

Innovation, collaboration and technology transfer to companies

At iNANO, we continuously strive to strengthen our collaboration with national as well as international companies. This goal is catalysed by the industrial companies' growing awareness of the potential and the possibilities that nanotechnology can provide for processes and resulting products. In 2008 iNANO's portfolio of industrial partners included more than 101 national and international companies.

Our collaboration with a company often begins with a co-financed PhD stipend, and in 2008 iNANO secured 8.7 million DKK for 14 co-financed scholarships from The Danish Council for Research Policy. Furthermore, by the end of the year a healthy fraction of 21% of our PhD students were co-financed by a Danish company. In the coming years we hope to further expand this fraction and thereby contribute to the effective knowledge transfer in a way, that may prove second to none.

iNANOhouse

The first turf for the building of the clean-room wing forming a part of a 10,000 m^2 laboratory complex was cut in August 2007. At the end of 2008, the new wing, containing a "class 100" clean room with an area of 210 m^2 including service areas, was finalized. When the clean room has been equipped with state of the art processing equipment, iNANO researchers will have excellent facilities to prepare and synthesize nanostructures of the highest quality and to train nano-students during their PhD or Master's projects. The remaining part of the laboratory complex is unfortunately somewhat delayed, and the complete complex will not be commissioned before the beginning of 2013.

Globalisation and China

An important goal for iNANO is to strengthen the degree of internationalization even further. Countries like China, USA, Japan and India are investing heavily in nanoscience in these years based on the expectation that nanotechnology will be decisive for their future competitiveness. In particular China is developing faster than any other nation, investments increase by about 20% each year, and the country has an enormous pool of highly-dedicated and talented students. We have to realize that China is already a pivotal global player with respect to economy, research and education, and it is of utmost importance that iNANO maintain and build up long-term relations with Chinese researchers. Therefore, iNANO has chosen to participate in the establishment of a Danish university centre in Beijing, and to play an active role. The goal is to intensify our cooperation with Chinese scientists, to enhance the visibility of our research and education in China, and thereby secure easier and better access to outstanding students for iNANO and Danish companies, and at the same time improve the possibilities for Danish students to study in China.

Acknowledgements

I would like to express my sincere appreciation for the tireless and devoted efforts which the scientists and the administrative staff of iNANO demonstrate year after year. They keep on performing outstandingly well, although they often work with very short deadlines. Heartfelt thanks also go to our students, who continue to surprise and thrill us with their enthusiasm and initiatives. On this basis, I am confident that iNANO is well prepared for any given challenge that might occur in 2009.

An interdisciplinary curriculum for Nanoscience

By Trolle Linderoth

Interdisciplinarity lies at the core of nanoscience and nanotechnology. Many of the most groundbreaking, current developments take place at the boundaries between the traditional disciplines of physics, chemistry, molecular biology and biology. This observation, along with the fact that the years of undergraduate education to a large extent define our mental framework and approach to science, call for an early introduction to all the core disciplines of nanoscience. At iNANO we offer dedicated Bachelor's and Master's programmes in Nanoscience where the goal of disciplinary breadth has been realized without sacrificing scientific depth. This has been accomplished by developing a fixed course programme involving carefully selected elements from the core disciplines combined with dedicated nanoscience courses and elective specialisation modules during the last years of study. Since its introduction in 2002 the annual uptake on this new study programme has counted 40-60 highly motivated and dedicated young students.

Bachelor's programme

During the first three years the students receive basic, interdisciplinary training in physics, chemistry, biology, molecular biology, mathematics and computer science. Many of the courses are followed along with students from these core disciplines. In addition, a number of courses address issues specific to the nano-area. In the course "Introduction to Nanotechnology" the first year students are introduced to key nano-concepts such as scanning probe techniques and bottom-up/top-down synthesis of nanostructures. The course ends with a two-week project which enables students to make close contacts with research groups at iNANO already at their first year. In the subsequent courses more advanced, experimental exercises and a bigger project, currently involving fabrication and characterisation of a dye-functionalised solar cell, are carried out. In the final year of the Bachelor's degree programme students can follow the courses "Nano-characterisation" and "Current Nanoscience" which introduce a number of experimental nanoscience characterisation techniques as well as important subject areas for current nanoscience research. A course on the theory of science dedicated to the nano-area places the subject in a societal context and emphasises ethical aspects. Elective course modules at the third year of study allow fine-tuning of the course programme to the particular interest of individual students. The Bachelor's degree programme is terminated by an individual Bachelor's project typically carried out in a research laboratory and supervised by iNANO researchers.

Master's project in nanotechnology		
Specialisation - 4	Innovation and Enterpreneurship	Specialisation - 10
Specialisation - 3	Specialisation - 6	Specialisation - 9
Specialisation - 2	Specialisation - 5	Specialisation - 8
Specialisation - 1	Student's colloquium	Specialisation - 7
Current nanoscience	Bachelor's project	Bachelor's project
Nano-charaterisation	Molecular structure	Experimental mol.bio.
Solid state physics	Elective-2	Bionanotechnology
Statistical mechanics	Elective-1	Fourier analysis
Quantum mechanics	Theory of science	Statistics and data processing
Non-classical physics	Nano project	Linear algebra
Numerical physics	Experimental nano-exercises	General molecular biology
Introduction to programming	Thermodynamics/kinetics	General biochemistry
Waves and optics	Organic chemistry	Nano intro
Electromagnetism		Basic biology
Mechanics/thermodynamics	Inorganic chemistry	Calculus - 2
Introductory mechanics	Introductory chemistry	Calculus - 1

Course programme for the interdisciplinary Bachelor's and Master's degree in nanoscience offered at iNANO. Each academic year (starting from the bottom) is divided into four 7-week quarters and typically three courses are followed in each quarter. Legend: Blue: Physics courses, yellow: Chemistry courses, orange: Molecular biology courses, red: Mathematics/computer science courses, green: Nanoscience courses, grey: Specialisation modules.

Master's programme

During their Master's study students are required to specialize in either of three different fields: nano-physics, nano-chemistry or nano-molecular biology. In doing so they choose from the extensive course catalogue at the Faculty of Science and follow course programmes developed through individual counselling. In the compulsory 'Student's Colloquium' the students gain experience in presenting a subject of their own choice to fellow students, and in the 'Enterpreneurship and Innovation' course they are introduced to concepts of commercialisation. The specialisation courses followed on the fourth year of study enable the students to commence their one-year master's project or alternatively to seek admittance to the iNANOschool PhD programme.

Graduate studies
iNANOschool

iNANOschool has by now developed into a graduate school in nanoscience of international stature with 123 PhD students enrolled. A broad range of specialized courses have been established, and iNANOschool students have access to highly advanced research facilities. The iNANOschool provides interdisciplinary competences in nanoscience and nanotechnology at the highest international level.

By Signe Osbahr and Tina Fredsted

iNANOschool was established in 2002 with the objective to educate highly qualified, internationally competitive PhDs with interdisciplinary competences in nanoscience and nanotechnology. iNANOschool offers a broad range of PhD courses within nanoscience and nanotechnology and provides facilities for and supervision of an increasing number of PhD students. Besides the focused PhD courses, such activities include a major annual meeting, an autumn school, student networks, and activities to promote the exchange with other international institutions, mainly in Europe and Asia. The research areas within iNANO and iNANOschool are highly integrated as well as truly interdisciplinary and at present cover such diverse research fields as functional nanomaterials, nano-energy-materials, nanomedicine, self-assembled molecular nanostructures, nanofood, nanophotonics and -electronics, and nanotoxicology along with numerous basic, long-term generic nanoscience research projects. Overall, the research activities are at the international forefront of science and serve as an ideal framework for education and industrial collaborations.

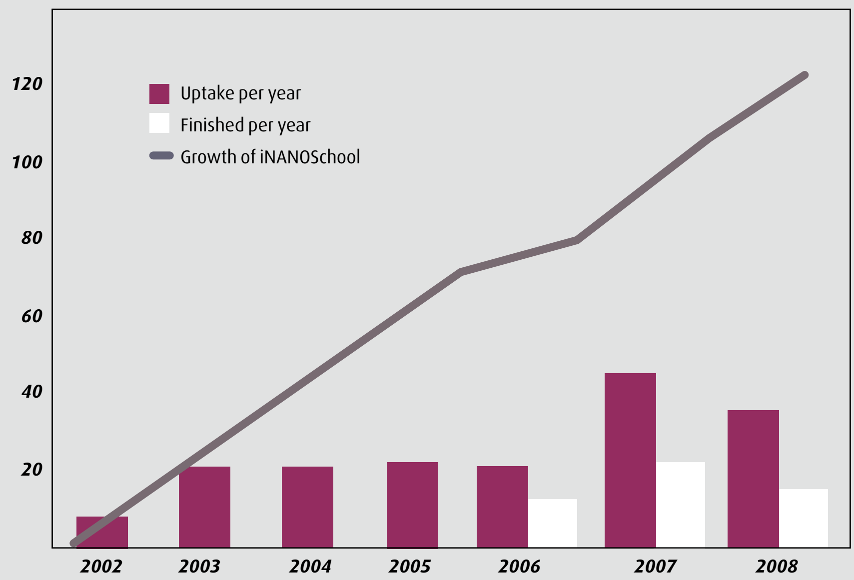


Figure showing the growth of iNANOschool from 2002 to 2008.

During 2008 15 PhD students completed their PhD studies, and 35 new PhD students were enrolled in iNANOschool. The social aspect of being associated with iNANOschool is also important to us, and therefore an introduction meeting followed by an informal gathering is set up for all new PhD students during spring and a second information meeting is organised in conjunction with the iNANO Autumn School.

Academic Activities at iNANOschool

Courses

An important task for iNANOschool has been to establish a fairly large number of new PhD courses within nanoscience and nanotechnology. These courses serve to educate the students in high-priority research fields together with innovation, commercialisation and ethical aspects of nanotechnology. Moreover, a course to improve the abilities of PhD students to communicate their research in oral as well as in writing has been established. Most courses are offered on an annual or biannual basis and are primarily structured as intense one- or two-week courses. In that way, the interference between courses and research projects or stays abroad is kept at a minimum. It is worth noting that other national and international institutions also benefit from the iNANOschool courses by sending their students to iNANO for short visits. In return iNANOschool's PhD students get excellent networking opportunities with students from other institutions. During 2008 iNANOschool offered the following courses: Biointerfaces and Biocompatibility at the Nanoscale, Bionanotools and Protein Structure, Drug Delivery, Innovation and Entrepreneurship, MONET PhD School and iNANO Autumn School.

The course Biointerfaces and Biocompatibility at the Nanoscale was organised together with the EU Network of Excellence, Frontiers, as a one-week intense course at Fuglsøcentret near Aarhus. The course aimed to give an introduction to the interaction between artificial biomaterials and biological systems with emphasis on the mammalian physiological systems, including humans. All aspects were covered from biomolecular adsorption on chemically or topographically nanostructured solid-state materials through the subsequent cell adhesion to tissue regeneration and long term performance of biomaterials in vivo. The MONET PhD School organised in collaboration with the Marie Curie Early Stage Researcher Training Network MONET also took place at Fuglsøcentret. The school aimed to provide students with both background and recent advances in the rapidly advancing field of molecules and functional structures on surfaces as studied primarily by UHV surface science techniques. Both courses gained from an international atmosphere with almost half of the participants being from highly esteemed research centres in other European countries. The one-week course model at a remote location provides the students with unique opportunities to interact with each other and with the lecturers in an informal setting.

Graduate studies iNANOschool

Two of the courses were organised at Aarhus University in order to be able to use the experimental facilities. The aim of the Bionanotools and Protein Structure course is to introduce the students to a number of analytical measurements and analytical tools used for the structure-function analysis of biological macromolecules, or biological nanomachines such as functional proteins, membrane pumps and channels. The aim of the Drug delivery course is to provide insight into theory and technical requirements for delivery of nucleic acid-based gene silencing therapeutics in established cell lines, primary cells and animals. The last course, Innovation and Entrepreneurship, introduces concepts of commercialization, which are highly relevant to anyone who wishes to enter into a commercial exploitation of nanotechnology. The course was co-organized as a combined undergraduate and graduate course.

iNANO Autumn School 2008

A very important part of the course programme is the annual iNANO Autumn School where iNANO brings together all PhD students enrolled in iNANOschool at Fuglsøcentret for an extended weekend from Friday morning to Monday evening. At the Autumn School students are supposed to present their research project either as an oral presentation or in a poster session. The intention is to catalyze discussions on the research activities and stimulate collaboration between the students. The PhD students receive feedback on their oral presentations and there is a competition for both best oral presentation and best poster. This year a new concept was introduced: In addition to the above mentioned components a workshop with a general theme spanning the entire autumn school was arranged. The theme this year was Sustainable Energy and Climate Change - Challenges, Criteria, Solutions, for obvious reasons since sustainable energy, climate changes and the challenges involved are of utmost importance to our society in the years to come.

As nanotechnology is expected to play a leading role in the development of sustainable energy sources and solutions to some of the global climate challenges, it is important for PhD students in nanoscience to participate in discussions and have basic knowledge about these areas. Raising the awareness of the emerging challenges, particularly amongst the future generations of scientists, seems essential for the development of successful solution strategies.

In preparation for the workshop all participants were asked beforehand to read the book 'The Hot Topic' by Sir David King and Gabrielle Walker. In addition four invited speakers, all experts in energy-climate related research, gave lectures that served as eye-openers and inspiration for further discussions. The four speakers were Professor Bengt Kasemo, Chalmers University, Professor Jørgen Olesen, Aarhus University, Professor Ib Chorkendorff, Technical University of Denmark (DTU) and Professor Claus Felby, LIFE , University of Copenhagen. The information in the book combined with the four lectures, enabled the iNANO PhD students to discuss the theme, regardless of their own particular research area. The students were asked to discuss and address the following vital questions:

- *Identify global energy and climate challenges*
- *Set up criteria for evaluating and prioritizing challenges*
- *Identify how nanoscience may contribute to solutions*

The majority of the discussions were carried out in smaller groups and issues like global challenge, urgency, global impact, sustainability, ethical-social implications, nanoscience potential, and costs were debated. At the end of the workshop all groups presented in plenum their views on the challenges and potential solutions and a general discussion across all groups completed the workshop.

Workshops/seminars

In order to stimulate interdisciplinary research activities and give all students direct access to the most recent research results on the international research arena, weekly iNANO seminars are operated with remarkable success. At these seminars, highly esteemed international scientists give tutorials on different aspects of nanoscience, and scientists associated with iNANO present their most recent results. The seminars are very popular, and typically about 80-100 graduate students and researchers broaden their horizons on current issues in nanoscience through these seminars. Another series of seminars is devoted to the iNANO specialized lectures, where more specialized topics such as specific state-of-the-art experimental techniques and results are presented.

All PhD students at iNANOschool also participate actively in the iNANO Annual Meeting, where outstanding, international scientists present talks on hot topics in nanoscience and nanotechnology. A poster session for PhD students and postdocs allows them to present and discuss their own projects and to gain knowledge about other current projects within iNANO.

Nanorama
– student organization

Nanorama is an organisation for undergraduate and PhD students at iNANO and iNANOschool. Nanorama is run by students and was established in the spring 2005. The organisation arranges student activities such as a "Nano Friday Bar", joint ventures with other student organisations on campus and various nano-related academic arrangements.

By the Board of Nanorama

The main goal of Nanorama is to strengthen the social contact between the nanoscience students; both within the year groups and the different classes. The goal is pursued by supporting and initiating different activities, such as the annual relay races and other casual activities such as the Nano Friday bar. Another aim of Nanorama is to organize nanoscience arrangements to give students a broader perspective on their studies and gain insight into the job opportunities when they finish university.

The Board of Nanorama consists of seven students spanning from first year students to PhD students, again with the mission to encourage nanoscience students to socialize among the classes and year groups. The Board is elected twice a year in the beginning of the semester, which gives the necessary flexibility for the board members to participate in the planning of Nanorama activities when they have the time, but also the opportunity to leave the Board after a short term to focus fully on their studies.

An example of the social activities arranged by Nanorama in 2008 was the participation in the local relay race "Aarhus 1900 relay", where iNANO students were represented by two teams and a large backing group, supporting them with food, drinks, and encouraging shouts. Another very successful social event was the yearly Christmas party in which many of the iNANO students participated.

Among the extracurricular events planned for 2009, three events should be mentioned. First to come is a panel discussion with relevant people from a trade union, the industry and a recently graduated student, who will answer questions from the audience about career possibilities and plans after graduation. Second on our schedule is a visit to two companies carrying out research in the field of nanotechnology, and finally three former iNANO students will in the spring 2009 give talks about how they, in their current jobs, use the knowledge gained during their studies at the iNANO center.

Nanoshow at iNANO

Eva Lykkegaard Poulsen
Kirsten Andersen
Katrine Svane
Henrik Hellstern
Niels Ramskov Bøje
Anna Julie Rasmussen

In the autumn of 2008 a new Nanoshow was established with the aim to teach high school students about various aspects of nanoscience and to clarify the great potentials for nanotechnology application.

By Tina Fredsted

iNANO is involved in a range of communication activities where the primary goals are to recruit new nanoscience students, to brand iNANO, the Faculty of Science and Aarhus University, and at the same time to raise the general public's awareness of nanoscience and nanotechnology. This is important, not least because nanotechnology is expected to form the backbone of the next industrial revolution.

In 2008 iNANO initiated the establishment of a Nanoshow. For several years the Faculty of Science has offered Physics and Chemistry Shows and our goal was to create something similar, and yet the Nanoshow should have a somewhat different focus. The primary objective of the Nanoshow is to learn mainly high school students interested in biology, chemistry and physics about nanoscience, rather than to entertain them with a show. Therefore, the Nanoshow is not primarily developed for a larger auditorium crowd, but rather for smaller groups of up to 28 students.

The specific purpose of Nanoshow is that the visiting students learn about nanoscience including some of the latest news within the field and leave iNANO with increased knowledge and awareness of nanoscience and nanotechnology. Hence, they will not be entertained with spectacular demonstrations, but rather learn about the basic principles, concepts and phenomena. Students will learn how nature behaves on the nano-scale, which forces play an important role, what is different from the macroscopic world and how nanoscience can be converted to nanotechnology.

There is not only one show but three different shows. In their present versions they focus on the three topics NanoMaterials, Nano-Energy-Materials, and Health & Life (Nanomedicine and nanobiotechnology), respectively. Each show consists of a 30-minute general introduction to nanoscience including small demonstration exercises, and is then followed by an approximately 45-minute "show" focusing on one of the three above-mentioned topics and including various relevant demonstrations. As an integral part of the show, the students will be informed about on-going research activities at iNANO, which span from the physics of semiconductor nanoparticles to drug delivery from nanoparticles. Central nano-characterization techniques like atom force microscopy and scanning tunneling microscopy will be presented, and nanocatalysis, energy materials, protein and enzyme functionality, self-assembly and nanocoatings are just some of the topics that will be introduced.

The shows consist of clear and concise Power Point presentations, with good illustrations, sometimes funny and colourful, and small experiments which enable the students to see for themselves what happens, and how things happen. iNANO students with outstanding communication skills will present these shows. The shows will be offered from January 2009, where also the new webpage will be launched (www.nanoshow.dk).

"Lab-on-a-tap" awarded the prestigious

Grundfos Challenge Innovation Price

The theme of Grundfos Challenge 2008 was sustainable development in the fast growing and fast developing BRIC countries. Three bright students from iNANO came up with an innovative concept, "Lap-on-a-tap", and won the Innovation price.

By Signe Osbahr

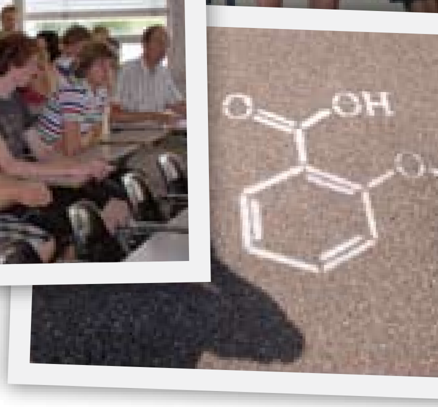
The BRIC-countries – Brazil, Russia, India and China – have experienced a fast economical growth during the last decade and their populations are among the largest on the planet, accounting for about 42% of the total world population estimated to be about 6.8 billion. Whilst these facts represent hope for mankind they do also imply serious environmental challenges, which must be met by stakeholders including companies like Grundfos, which has production and sales corporations in all BRIC countries. At the Grundfos Challenge 2008, the company asked the participants to focus on new approaches toward the market and technical solutions, which may lead to even more business opportunities. The goal was to identify new ways to reduce the energy consumption or secure the water supply in the four countries.

Students from all Danish institutions offering educations within engineering and natural science were invited to participate in the competition. The team representing Aarhus University in the engineering contest consisted of three iNANO students: Sofie Kastbjerg, Søren Porsgaard and Jakob Arendt Rasmussen. The main challenge for the competing teams was to come up with a visionary idea and a detailed implementation plan. To catalyze the process the students attended several presentations at the Grundfos site concerning branding, market potential, business strategies, economy, and patents, in order to gain insight into industrial terms and aspects, which are difficult to gather information about at the educational institutions. An additional task in the process was to establish a strong teamwork exploiting in full all the scientific and innovation competencies as well as social skills of all the team members.

The iNANO team came up with a visionary project, which aims to influence both water supply and energy consumption. Due to the dubious cleanness of tapped water in China and the consequent insecurity about the drinkability of the tapped water, a huge amount of bottled water is produced and sold to the Chinese households. This prompts an enormous use of energy for transport of the many bottles of water and a large waste problem due to the disposure of empty bottles. The iNANO students suggested a solution with a small sensor which can be installed on all taps in private households. The sensor would be based on an electrochemical (fuse-based) sensor technology, and is supposed to shine green, when pure water is running through the tap, and shine red, when the water is contaminated. The sensor was named "lab-on-a-tap".

The committee of judges consisting of a number of highly respected directors and research directors from Danish industry was impressed by the project which they thought elegantly combines branding of Grundfos in an innovative way and provides the necessary security for clean water to the customers. Therefore, the project of the three iNANO students was awarded the prestigious Innovation price of DKK 15,000. CONGRATULATIONS to Sofie, Søren and Jakob.

iNANO study tour 2008



by Kirsten Andersen and Niels Ramskov Bøje
(Photos: Erik Barløse Jacobsen)

It was Sunday the 22nd of June when 30 third-year students from iNANO left their everyday life in Aarhus to visit Germany and Switzerland. The purpose was to visit the nanocenters at the universities in Karlsruhe, Basel and Zürich. Below is a short summary of the iNANO study tour 2008.

Monday morning we arrived at Karlsruhe University, more specifically DFG-centrum für Funktionelle Nanostrukturen. Before lunch we attended three lectures including a very interesting lecture by Dr. Christopher Anson on using single molecular magnets and hydrogen storage. During the afternoon we were shown around at the science center and we visited three different research groups. In the evening our journey continued to Zürich, where we had a hostel waiting for us.

Tuesday morning we headed to Basel to visit the Institute of Physics and Biozentrum. After a short introductory lecture to nanoscience and nanotechnology, three PhD students guided us around to five different research groups. In the STM group, they complimented the group in Aarhus as being among the best in the world. An interesting project was their Cryolab where they work with quantum dots with the purpose to create a quantum computer. The activities in Basel are truly interdisciplinary, and for the more bio-interested, we visited a research group working with biosensors. They use functionalized AFM cantilevers with DNA, proteins or other molecules adsorbed on the cantilever, and have developed a chip with several cantilevers, which can be used as a sensor for many different environmental agents. After the lunch break we were taken to the Biozentrum where they use AFM to study functions and dynamics of membrane proteins.

On Wednesday we had a rather busy and tight schedule from 9.00 to 17.00, where we visited ETH in Zürich. In the morning we visited Nanomat, Biologically Oriented Materials group headed by Professor Dr. Viola Vogel, where we heard lectures about nanoshuttles with kinesine attached to the edges of nanosized tunnels. These nanoshuttles are used to “walk” microtubules along the tunnels. Molecules can be attached to microtubules and thus, this is a method to transport molecules in a chosen direction. After a delicious barbeque, which they had planned for us, we visited the Laboratory for Surface Science. We had six lectures on different aspects of surface science, ranging from commercially applicable coatings to replicating the lotus effect and to the use of paramagnetic nanoparticles in MRI scanning. After dinner, we joined the locals and watched the semifinals of Euro2008 together in a pub.

The final day of our study tour was spent sightseeing in Zürich before heading home to Aarhus in the afternoon, with our minds filled with new impressions and information.

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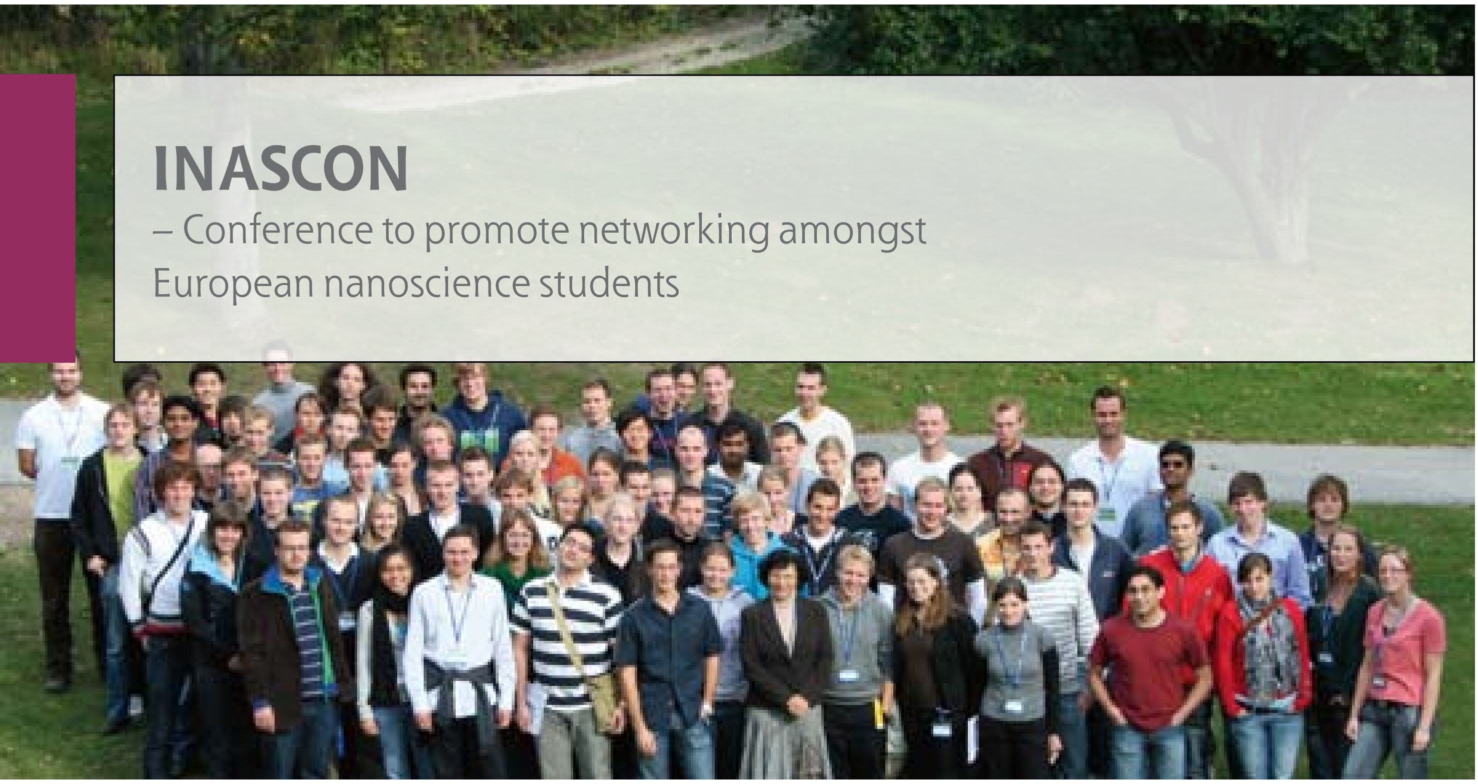
We acknowledge the kind support from TUBORGFONDET and ROBLON FONDEN which made this tour possible.

INASCON

– Conference to promote networking amongst European nanoscience students



In 2008 six nanoscience students from iNANO organized the INASCON conference for undergraduate nanoscience students from all over Europe for the second year in succession. The aim of the conference was to promote networking amongst young nanoscience researchers, and to expose young students to current development and possibilities in nanotechnology.

By Kasper Jahn

In a broad field such as nanoscience it is vital to establish contact with scientists at other universities, who have expertise in other areas of research, as it can lead to potential collaborations. The goal of INASCON was to promote networking at a very early stage in the careers of young scientists, and therefore the conference was arranged for students, as opposed to normal conferences that tend to focus on established researchers. To catch the interest and broaden the perspectives of the students, talks on hot research topics were presented along with talks on less hard-core, but important issues such as health risks of nanotechnology and employment possibilities. Another important focal point of this year's conference was to provide the students with some tools to help them improve their presentation skills.

The major part of the funding for the conference was supplied by the Frontiers Network of Excellence. Additional generous grants were received from Tuborgfondet, Oticon Fonden, The Danish Ministry of Science, Novo Nordisk, Fabrikant Mads Clausens Fond, Familien Hede Nielsens Fond, Danisco, Swiss Nanoscience Institute and Grundfos. Without the generous support from these sponsors, the conference would not have been possible.

Students from eight countries

100 students representing11 universities and 8 different European countries attended INASCON, and right from the outset the students started networking with one another. The setting of the conference was Fuglsøcenteret, located near Ebeltoft in Denmark, which offers excellent possibilities for students to walk-and-talk along a beautiful part of the Danish coastline.
The conference proceeded very smoothly with exciting lectures on hot topics in nanoscience presented by experienced researchers. In addition, nine students gave excellent presentations of the work they had performed so far during their short scientific career. The conference also contained a poster session, which gave the students the opportunity to learn about research carried out by other participants.

A panel discussion with focus on the transition from the academic life at a university to a career in the high-tech industry was held with participation of representatives from academia and industry in the panel: Ove Poulsen (Vice-chancellor, Engineering College of Aarhus), Anders Bentien (Grundfos), Charlotte Poulsen (Danisco), Finn Folkmann (AC-trade union representative AU). These four participants each gave a short presentation pointing out what they find important when making the transition from academia to industry. Afterwards the students could ask questions to any of the four panel members. This session was highly praised by the students, who generally were in doubt about their employment possibilities after graduation due to the fact that nanoscience educations are still so new that no reliable employment record is yet available.

Finally, after every day with intense exchange of information, everybody met in the evening to get a couple of beers and continue networking in an informal setting.

Overall, the INASCON conference was a great success, and the feedback from the students was very positive indeed. Next year the INASCON conference will be held in Switzerland in the period from 20-23 August.

7th iNANO annual meeting 2009:

Dealing with increasing complexity

Nanoscientists are inventing a wealth of increasingly complex materials and nanodevices with sophisticated functions that may enable the development of self-fabricating factories, self-powered nanorobots, fast genome sequencing, medical sensors circulating the blood stream and intelligent drug delivery systems.

By Rolf Haugaard Nielsen
Science journalist

"In the beginning was the Big Bang, and physics reigned. Then chemistry came along at milder temperatures; particles formed atoms; these united to give more and more complex molecules, which in turn associated into organized aggregates and membranes, defining primitive cells from which life emerged. From divided to condensed, organized, living and up to thinking matter, the universe has evolved towards a progressive complexification of matter, through a process of self-organization under the pressure of information".

The first speaker at the iNANO annual meeting 2009, the 1987 Nobel Prize winner in Chemistry Jean-Marie Lehn from Université Louis Pasteur in Strasbourg, wrote this beautiful and inspirational introduction for a recent review on supramolecular chemistry – a term he coined himself years ago – and in his talk he showed the audience how far nanoscience has proceeded along a similar path.

While molecular chemistry is based on molecules joined by covalent bonds between their constituent atoms, supramolecular chemistry explores the assembly of molecules that spontaneously generate complex structures on the basis of the information stored in their molecular components; thus behaving as programmed systems. "If we can understand and control supramolecular systems well enough, high-tech industries may be able to move from fabrication to self-fabrication. This is an important concept for the future", Lehn advocated.

A powerful tool for self-assembly of supramolecular structures is metal ion coordination, which provides "the cement to link together the bricks". These supramolecular structures can then be manipulated through oxidation and reduction leading to binding or release of the ions, and such processes may be exploited for developing superior nanoelectronic components based on molecular spintronics. Jean-Marie Lehn and his co-workers have even made supramolecular structures that are able to move and carry out mechanical work at the nanoscale in a fully controlled and reversible manner; an example is helixes that stretch out to form long and stable chains when they pick up metal ions from a solution and folds tightly like an accordion when the metal ions are removed.

Finally Jean-Marie Lehn introduced a new paradigm – constitutional dynamic chemistry – where both the molecular building blocks and the supramolecular structures contain reversible bonds and are able to undergo continuous change. This allows for self-organization by selection and thus adaptation to a changing environment in a manner that resembles natural evolution. "The research is based on a simple and powerful idea – lock and key. First we make the chemical lock and then create a lot of flexible molecular and supramolecular building blocks which change and adapt until the best possible key has evolved by self-organization. Our approach combines information and programmability with dynamics and reversibility and points towards the emergence of a new adaptive and evolutionary chemistry of increasing complexity. This is the goal", Jean-Marie Lehn said.

Communicating protocells

Hagan Bayley from Oxford University took the audience on a grand tour into the realm of synthetic biology; the aim of his research is to manufacture micro- and nanomachines from simple organic parts. Such micromachines may be motile, able to generate, store and use energy, capable of sensing and able to take up substrates and convert them into products.

Bayley works with aqueous droplets that become encased by lipid monolayers when submerged in an oil-lipid mixture. When such droplets are brought into contact they form robust interface bilayers that link them together and resemble primitive cell membranes. Proteins such as α-hemolysin pores can be inserted into these bilayers allowing the droplets to communicate with each other by exchange of ions. The interactions between the droplets can be manipulated by using genetic engineering to alter the pores in order to change their conductance or ion selectivity or to control when they open and close. "We have made the first multicellular networks of droplets that can be regarded as communicating

7th iNANO Annual Meeting 2009

How to solve complex nanostructures?

Nanoscientists are producing lots of complex materials with functions that depend on local atomic structures within the average crystalline lattice. An example is nanostructured bulk materials with internal domains that can easily be switched to produce large magnetic, electronic or thermoelectric responses. Another example is mesoporous materials with nanoscale pores, which show great promise as carrier materials in catalysis.

Unfortunately, it is extremely difficult to solve the structure of such materials by x-ray crystallography. "This is the nanostructure problem", Simon Billinge from Columbia University in New York pointed out. "However, to understand and design complex nanomaterials it is essential to be able to perform high resolution structural characterization".

For pure crystals, it is possible to determine their atomic structure. But for advanced nanomaterials with built-in domains measuring 1-10 nanometres ordinary x-ray crystallography fails and new approaches are much in need. Billinge told the audience about a promising method based on the atomic pair distribution function (PDF).

When illuminating nanostructured materials with powerful x-ray beams from synchrotrons this method utilizes not only the Bragg peaks showing which atoms are present, but also the diffuse scattering coming from irregularities in the sample. "Performing a PDF calculation is like sitting on a chosen atom looking around at the neighbourhood. First we calculate the probability of finding another atom nearby and then we run calculations to locate other atoms further and further away. In this way it may be possible to elucidate local structures within complex nanomaterials", Simon Billinge told the audience.

synthetic protocells or prototissue", Bayley said. "Such networks can also perform as electrical circuits or bio-batteries or act as light sensors, when a light sensitive bacterial protein is also incorporated into the bilayers".

The α-hemolysin pores look like mushrooms with the stem penetrating the droplet interface bilayer. Bayley and his co-workers have inserted doughnut-shaped molecules called cyclodextrins into the stem and used them to distinguish between the four nucleotides making up DNA. This may lead to cheap and extremely fast genome sequencing in the future. "To fulfil this promise single nucleotide discrimination is mandatory. A possible route is to use enzymes to cleave off one base at a time from the DNA strand before it reaches the membrane spanning domain of the nanopore", Hagan Bayley said.

Improving drug delivery

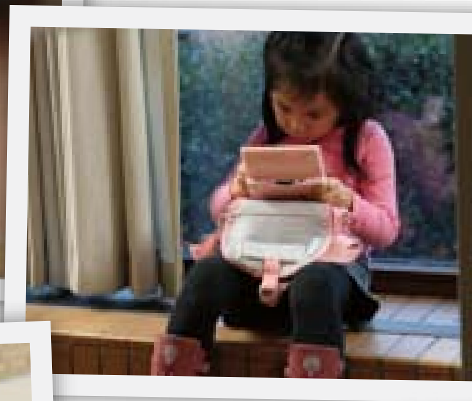
Tejal Desai from the University of California in San Francisco focused on applications of nanostructured drug delivery systems that may overcome unmet needs of present drug delivery technology. Some of the most important challenges are continuous release of therapeutic agents over extended time, local delivery to avoid systemic toxicity and improved ease of drug administration.

Today many protein and peptide drugs like insulin need to be injected daily, but an ideal delivery system would release such drugs into the blood stream at a constant rate for a month or more. Desai has shown that nanopores loaded with drugs are up to the task when the pore size gets so small that it approaches the size of the therapeutic agent. "It is like a crowded theatre with only one small door. It makes no difference whether a hundred or a thousand people want to get out, their speed is limited by the size of the door, and thus they leave at a steady pace", said Desai. Animal experiments have shown a 100 per cent drug release at a constant rate over three months from a subcutaneous implant with nanopores.

Most people prefer pills to injections or implants, but for many drugs the oral route is particularly difficult. One reason why is the barriers in the gastrointestinal tract that protect us against pathogens. In order to ferry drugs from the intestines into the blood stream Desai and her co-workers have developed both planar and ball shaped microdevices made from degradable polymers. These drug containers are equipped with nanowires of the same size as the hair-like structures on the surface of the cells in the gastrointestinal lining. The nanowires and the hairs stick together like a Velcro lock and thus the microdevices adhere strongly to the cells. Experiments in a rodent model have shown that nanospheres with wires targeted the small intestine and stayed attached while releasing their drugs. "This resulted in high drug permeability through the gastrointestinal lining", Tejal Desai said.

Power plants for nanomachines

Nanoscientists all over the world are working hard to develop nanomachines, nanorobots, intelligent medical implants, and mobile environmental sensors. However, a key challenge is to find a power source for such devices. Batteries are not up to the task because to be able to last for months or years they will inevitably be too big.



Zhong Lin Wang from Georgia Institute of Technology in Atlanta presented a very promising solution – piezoelectric nanogenerators – that draws energy from their environment. In the human body these nanogenerators may harvest hydraulic energy from the blood flow, mechanical energy from body movements or chemical energy from glucose and convert it into electricity. Such a nanogenerator may power an implanted medical sensor with a wireless radio transmitter to report the results. In the environment an autonomous nanorobot could draw energy from vibrations, e.g. from road traffic, or the nanogenerator could be supplied with energy from afar using ultrasonic waves.

To generate electricity Wang utilizes nanowires of zinc oxide, which are both semiconducting and piezoelectric. In the first experiments he pushed a standing nanowire with the tip of an AFM-microscope. As the piezoelectric wire bends a voltage develops, which is subsequently released as direct current to the conductive tip. Now Wang and his co-workers have developed zigzag electrodes bending a lot of nanowires in one stroke to generate milliwatts of power as well as flexible brushes that produce current as they move back and forth against each other.

These piezoelectric nanogenerators are now finding their first applications. "We have made textile fibre based nanogenerators that have been woven into shirts and tents that convert movements into power for portable electronics in the field", Zhong Lin Wang told the audience. So as soon as anybody comes up with a smart autonomous nanorobot which is able to sense and adapt to the environment, manipulate objects, take action and perform complex functions Wang's piezoelectric nanogenerators are ready to keep it going.

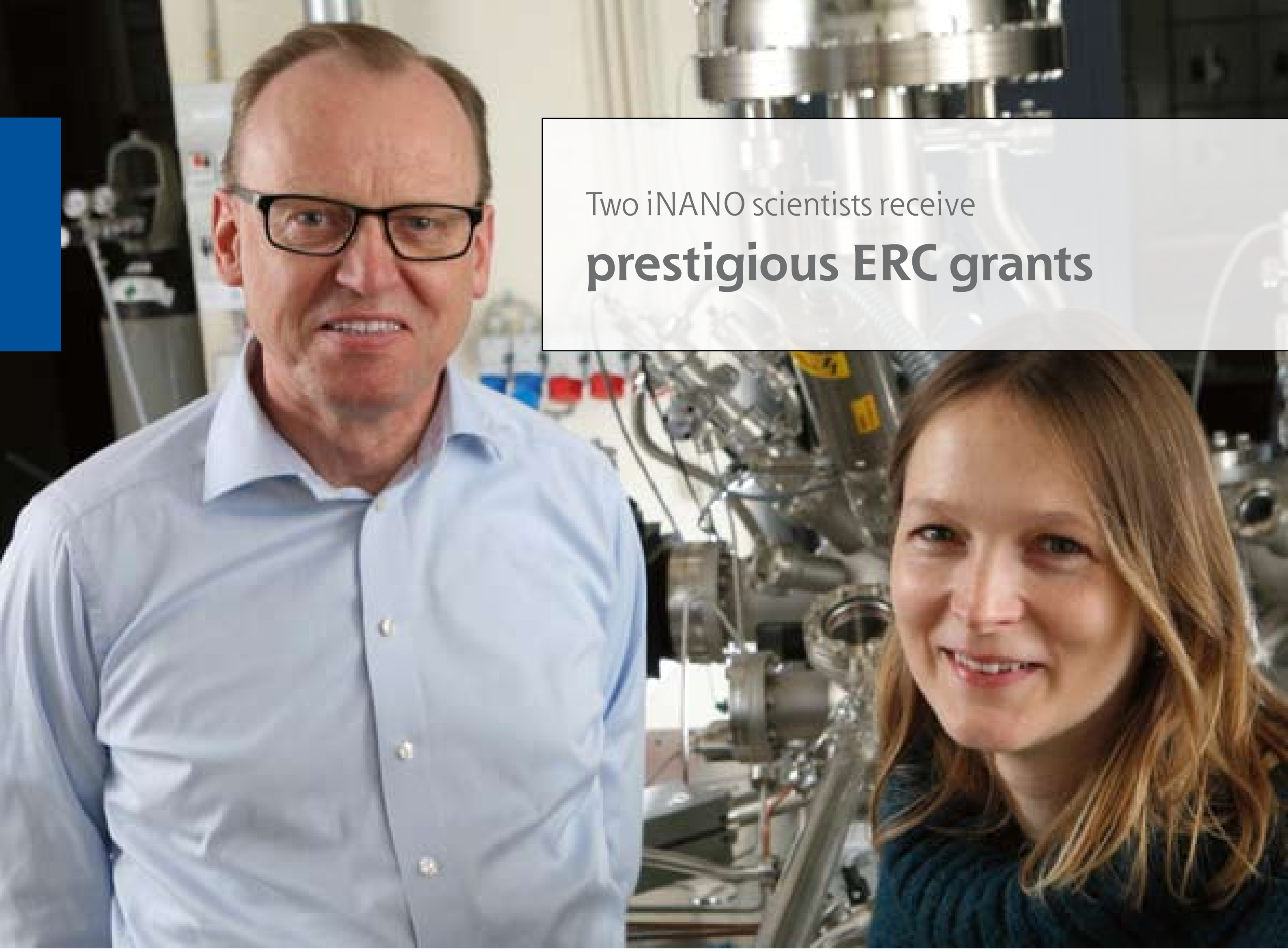
Nanoparticles for sensing and diagnostics

When a light from a laser beam hits a sample the energy of the reflected light from the illuminated spot may be shifted up or down due to interactions with phonons – that is lattice vibrations - in the sample. This method is called Raman spectroscopy, and since the vibrational information is specific for the chemical bonds in any molecule, it provides fingerprints of the molecules present in the sample.

Unfortunately, Raman scattering is weak, but years ago Richard Van Duyne from North Western University in Illinois was among the pioneers developing a powerful method called surface-enhanced Raman spectroscopy (SERS). When the illuminated sample is placed on top of a noble metal collective electron excitations - surface plasmons – occur in the metal surface and these plasmons enhance the Raman scattering by as much as a factor 106. This in turn increases the sensitivity of the method dramatically.

In his talk, Richard van Duyne told the audience about the latest development called localized surface plasmon resonance (LSPR) spectroscopy. When a single nanoparticle or clusters of nanoparticles of silver or gold interact with the incident laser light this generates surface plasmons that oscillate locally around the nanoparticles. Such plasmons are able to enhance the Raman scattering by up to a factor 1010. LSPR may be utilized in different ways to develop extremely sensitive chemical and biological sensors as well as diagnostics kits. "LSPR make it possible to detect and identify individual molecules", Van Duyne said.

Van Duyne and his co-workers are now developing a nanoparticle based glucose sensor to be implanted beneath the skin of diabetes patients, and experiments in rats have shown that such sensors can be accessed transdermally with a laser beam. "Thus, diabetes patients could be equipped with a small portable Raman spectrometer to take frequent glucose readings. In just five years handheld spectrometers may be produced for only a thousand dollars", Richard Van Duyne predicted.



Two iNANO scientists receive

prestigious ERC grants

Two iNANO scientists were awarded with ERC (European Research Council) grants in 2008. Liv Hornekær's project aims to uncover hydrogen interaction with polycyclic aromatic hydrocarbons in interstellar space and to utilize this insight to develop a novel approach to hydrogen storage. Flemming Besenbacher received a grant to develop scanning probe microscopes able to acquire atomic resolution images at video-rate frequencies.

By Rolf Haugaard Nielsen

In 2007, the European Research Council launched a new funding scheme under the Seventh Framework Programme with the aim to support individual researchers doing research at the frontiers of science. The first of these prestigious grants – 80 in total - were awarded in 2008 and despite fierce competition from a thousand scientists from all over Europe Liv Hornekær received a Starting Independent Researcher Grant of EUR 1.5 million, while Flemming Besenbacher was awarded an Advanced Researcher Grant of similar size.

Hydrogen and PAHs

Liv Hornekær's project "Hydrogen interaction with polycyclic aromatic hydrocarbons – from interstellar catalysis to hydrogen storage" aims to uncover the interaction at the atomic level between hydrogen and polycyclic aromatic hydrocarbons (PAHs). The project has a basic, scientific objective and an application-oriented goal.

Astronomers expect PAHs to be ubiquitous in the interstellar dust and molecular clouds where new stars and planetary systems form. Hornekær will investigate whether PAHs in these regions play a crucial role as catalysts for one of the most important interstellar chemical reactions - the formation of molecular hydrogen. Theory suggests that hydrogen atoms will bind to PAHs and unite to form molecules.

If this turns out to be the case, the discovery will affect both the present-day models of star formation and our understanding of the formation of complex, biologically relevant molecules in interstellar space. Subsequently, the knowledge obtained will be used to investigate the potential of PAHs as a hydrogen storage medium. The aim is to demonstrate a completely novel approach to hydrogen storage at a proof-of-principle level.

Hornekær's project is characterized as a high-risk/high-gain project, since it addresses major questions within both astrochemistry and hydrogen storage, and carries the promise to provide unconventional answers. Furthermore, the research will employ and develop a broad range of advanced experimental techniques.

The outcome will be an in-depth understanding of the interaction of hydrogen with polycyclic aromatic hydrocarbons, a possible revolution of present-day astrochemical models, and a feasibility study of a completely novel approach to hydrogen storage, which could have great tech-

Liv Hornekær and
Flemming Besenbacher

nological potential and contribute to the hydrogen society as part of a future sustainable energy system.

Atomic scale videos

For most commercial scanning probe microscopes (SPMs), it takes about five minutes to record an atomic resolution image of the surface. The home-built Aarhus Scanning Tunneling Microscope (STM) is famous worldwide for its ability to record dynamic images at a rate of one frame per second. In recent years, this unique quality has lead to a number of important discoveries. For instance, the research of Flemming Besenbacher's group has made it possible to develop some of the very first successful industrial catalysts designed from a fundamental surface science input; an example is the commercial desulphurization BRIM catalysts developed in close collaboration with Haldor Topsøe A/S.

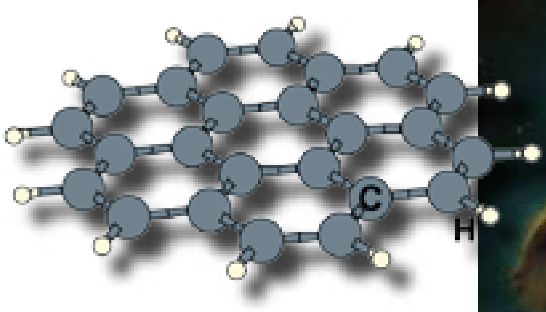
The advanced ERC grant will enable Flemming Besenbacher and his co-workers to develop a new generation of SPMs that will make it possible to acquire atomic scale movies of dynamic reactions with a speed comparable to video cameras recording 25-50 images per second. This will open up entirely new avenues of research in areas such as catalytic reactivity of surfaces and nanostructures, self-organization of organic, molecular nanostructures on surfaces, and in studies of biomolecular processes and interactions under physiological conditions.

Concerning STM microscopes, video-rate frequencies are already within reach. At a later stage, a video-rate STM for studies of light-induced chemical reactions and an STM working inside a high-pressure cell will be developed. The goal is to carry out atomic scale studies of catalytic processes under pressures and temperatures that are close to industrial conditions.

Once a video-rate STM is up running the next major technological challenge will be to develop video-rate atomic force microscopes (AFMs). The objectives are twofold: To develop a dynamic fast scanning AFM to be operated under ultrahigh vacuum conditions for the study of non-conducting oxide surfaces such as for example alumina – a natural extension is to implement such an AFMs inside a high-pressure cell. Second, to develop a fast-scanning AFM to be implemented inside a liquid cell to study the dynamics of biological processes in atomic detail, e.g. the mobility of membrane proteins on the surfaces of living cells. Such a truly revolutionary AFM may also help to reveal the protein fibrillation mechanism involved in protein folding diseases like Alzheimer's disease, and provide real-time movies of the action of enzymes and antimicrobial peptides on surface attached bacteria under physiological conditions.

The next generation of fast scanning STMs and AFMs may also lead to scientific and technological breakthroughs in supramolecular chemistry, including studies on how large molecules bind to, interact with, migrate and self-assemble into organized molecular patterns and nanostructures on surfaces. Such video-rate movies with atomic resolution are expected to lead to profound new insights into the subtle balance of forces that control the formation of supramolecular aggregates. This in turn may open up new possibilities for programming and controlling these processes, eventually enabling self-fabrication of molecular nanostructures. Furthermore, very fundamental questions such as the possible origin of the homochirality of life may be answered by studying single chiral biomolecules on e.g. stepped surfaces.

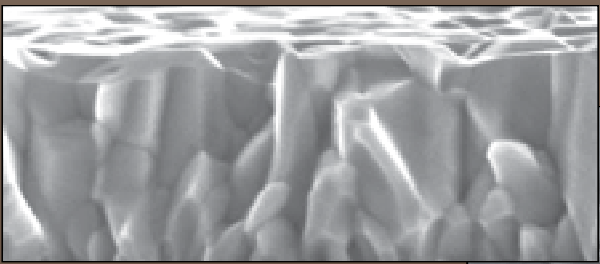
To see examples of Aarhus STM movies go to the website: http://www.phys.au.dk/spm/stmmovies.shtm

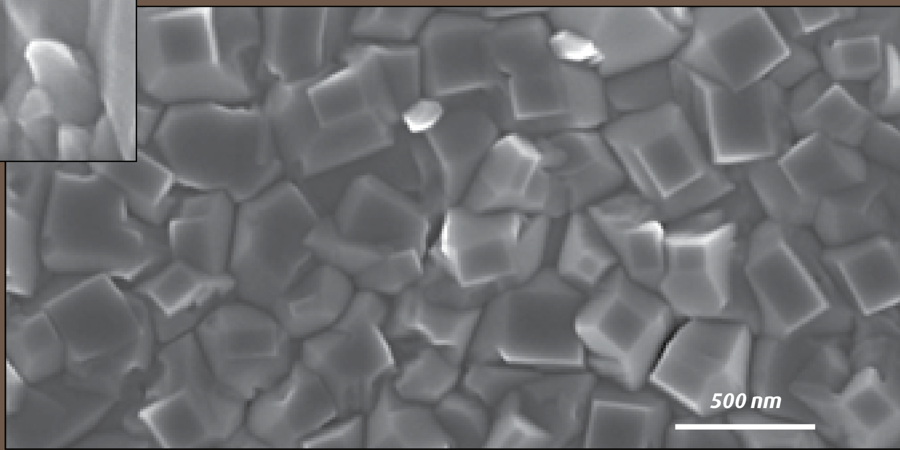


From Hester, J. & Scowen, P. (1995, November). Star-Birth clouds, NASA

Polycyclic aromatic hydrocarbons (left) may catalyze the formation of molecular hydrogen in star forming regions such as the Star-Birth-Cloud M16 (right). (Photo HST-NASA)

Nanomaterials for a clean energy revolution





This scanning electron microscopy picture shows a patented $FeSb_2$ thin film on silicon. $FeSb_2$ has a power factor 10 times larger than any other known thermoelectric material.

The world needs new and sustainable energy sources. Research on nano-energy-materials may enable us to turn organic waste into biofuels, convert waste heat into electricity, or produce hydrogen by sunlight. A breakthrough in just one of these areas is bound to have a monumental impact on modern society.

By Bo Brummerstedt Iversen, Ye Sun and Mogens Christensen

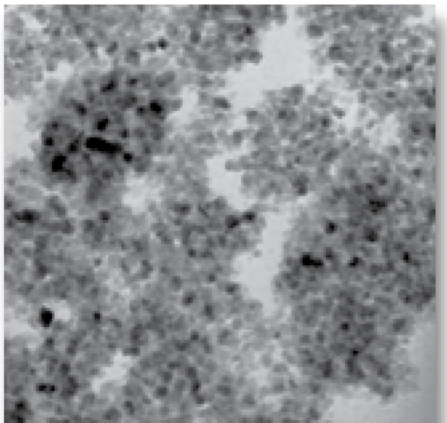
The global energy crisis and lurking climate changes urge the development of new environmentally friendly energy sources. Imagine that we could convert waste heat from industry or car exhausts into electricity, produce hydrogen from solar energy and store it for mobile applications, or turn organic waste into diesel fuel. This may indeed become possible by exploring the unique properties of nano-energy-materials.

At the Centre for Energy Materials (CEM), we carry out international cutting-edge research on emerging energy technologies with the aim of rapid commercial application. Some of the most promising target areas are given below.

Thermoelectric materials

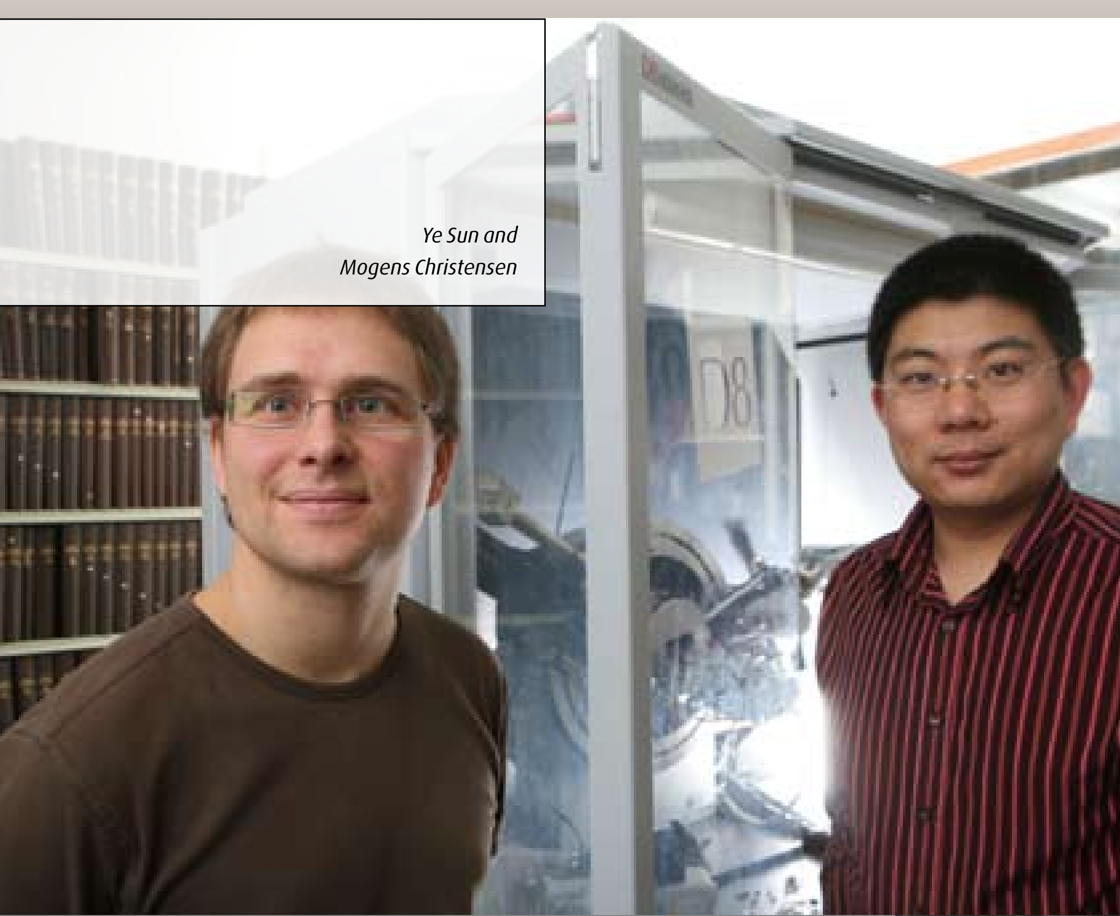
Thermoelectric materials are capable of electrical-thermal energy conversion and may be utilized for power generators that convert waste heat into electricity or for cooling devices. Many new thermoelectric materials are based on a design strategy called the "phonon-glass and electron-crystal concept", where the ideal material conducts heat poorly like an amorphous material and at the same time performs as a good electrical conductor just like a crystal. In such materials, a high proportion of the thermal energy can be converted into electrical current.

The collaboration within CEM allows for materials synthesis and characterization as well as thermoelectric system modelling combined with module fabrication and testing, and this multidisciplinary approach assures a fast route from preparation of novel materials to commercial implementation. Our current work focuses on novel, complex bulk nanomaterials and low-dimensional materials such as nanoparticles and thin films.



Nanoparticles of titanium dioxide (TiO_2) show promise for photo-catalysis; splitting water into oxygen and hydrogen using sunlight as the energy source.

Recently, a patent was taken on iron antimonite ($FeSb_2$), which has exceptional properties with a power factor 10 times larger than any known material, and thus potentially a high energy conversion efficiency. Further reduction of its thermal conductivity through alloying or nanostructuring would result in a promising material for low temperature cooling applications, e.g. to cool superconducting cables in the power transmission system.



Ye Sun and Mogens Christensen

Bo Brummerstedt Iversen

Centre for Energy Materials

The Centre for Energy Materials has united and vastly expanded the energy materials research at iNANO, Aarhus University, and the Institute for Energy Technology, Aalborg University. The research activities are integrated with strong technical expertise from industrial partners aiming at end-use applications. In addition, CEM offers the highest level of energy education in Denmark and thus educate highly skilled employees for the energy industry.

Solar hydrogen production

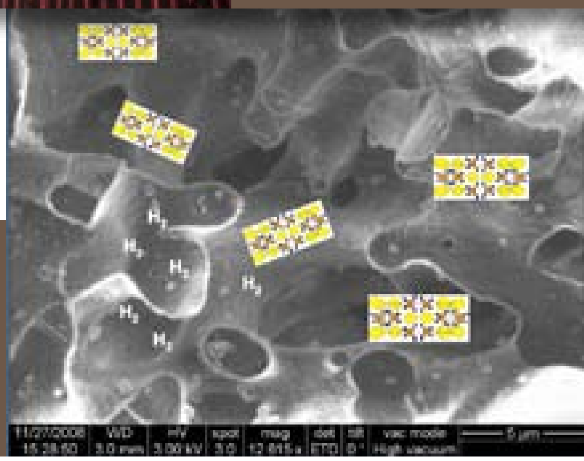
Solar energy is clean and plentiful and thus the ideal renewable energy source, if effective and reliable technologies can be developed to harvest it. As a non-polluting energy source, hydrogen can be produced from water splitting through a photo-catalytic process using sunlight. However, at present the hydrogen yield is too small.

To improve the production efficiency, CEM carries out highly innovative research on new photocatalysts. A breakthrough may be achieved, for example, by optimizing the band gap, by controlling the size of the catalytic nanoparticles, or by doping the nanoparticles with metals.

Hydrogen storage materials

Hydrogen has a very low volumetric energy density at ambient conditions and even as liquid hydrogen. For transportation, effective gas storage is the Achille's heel of the hydrogen society.

CEM synthesizes and characterizes novel hydrogen storage materials capable of storing hydrogen at increased densities. Ultimately, CEM aims to create novel nanocomposite materials that combine physisorption and chemisorption in order to enable fast up-take and release of hydrogen from the storage material.



Metal hydrates for hydrogen storage can be imbedded in nanoporous scaffold materials. At low temperatures, hydrogen molecules can be physisorbed by the storage material.

Nanoparticles for energy applications

The large surface-to-volume ratio of nanoparticles greatly improves their ability for catalysis and surface absorption, and nanoparticles can also have remarkably enhanced thermoelectric properties due to much reduced thermal conductivity.

CEM is synthesizing, characterizing and implementing a range of novel nanoparticles with emphasis on hydrogen production and storage, thermoelectrics, and photo-catalysis.
Robust design principles for reactors utilizing a revolutionary new technology called supercritical synthesis are under development. Supercritical processes are simple, efficient, very applicable for industry, extremely environmentally friendly, and lead to cheap and high quality nanoparticles.

Biofuels from organic waste

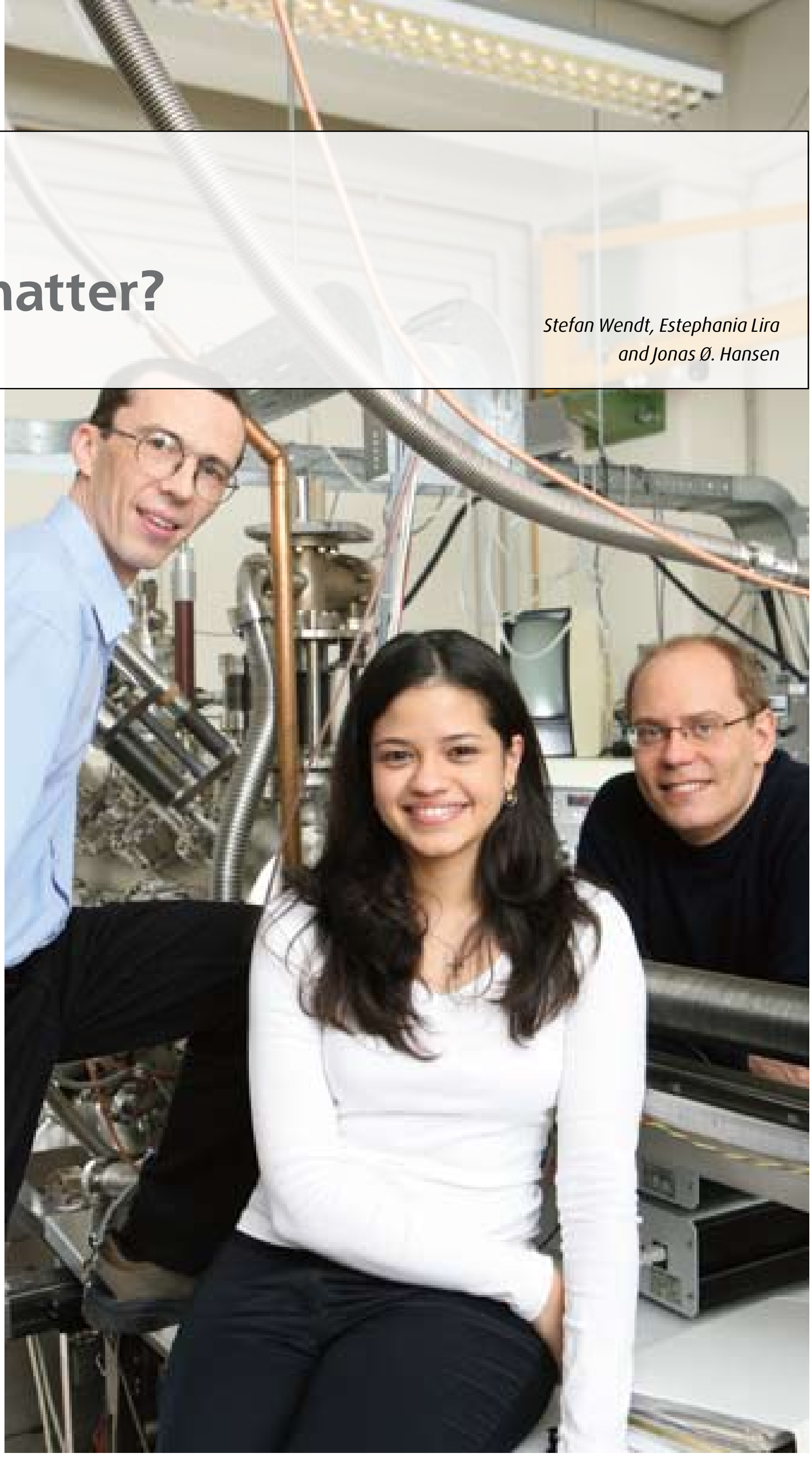
High-pressure conversion of wet biomass to transportation fuels is a novel technology capable of turning organic waste into energy for the benefit of the environment and reducing the dependency on fossil fuels. The company of SCF Technologies A/S, participant of CEM, has developed a 2nd generation technology, the Catliq® process, to convert waste and biomass residue into bio-oil in hot pressurized water in the presence of catalysts. CEM conducts laboratory tests to improve product yield and quality.

All the above-mentioned research areas may lead to important breakthroughs, and by combining outstanding academic, technological, and industrial expertise, CEM finds its unique strength to contribute to the clean energy revolution.

Titanium dioxide:

What defects matter?

Stefan Wendt, Estephania Lira and Jonas Ø. Hansen



Titanium dioxide is a widely used material in catalysts, gas sensors, and solar cells. The functionality leading to its use in many applications is enabled by a defect state in the material that supplies excess electrons. A new theory explains the origin of this defect state and may lead to technological breakthroughs.

By Stefan Wendt, Estephania Lira and Jonas Ø. Hansen

Titanium dioxide (TiO_2) is an intriguing oxide material that is used in a number of technological fields, including heterogeneous catalysis, photocatalysis, solar cells, gas sensors, waste remediation, and biocompatible materials. TiO_2 is an inert wide band gap insulator, but when reduced to titania (TiO_2-x) a broad range of applications are enabled by excess electrons originating from a defect state that is located within the band gap. Understanding the origin of this defect state is important for improving or expanding the scope of TiO_2-based systems for specific applications.

Conventionally, the defect state has been fully ascribed to oxygen vacancies in the surface, because from each vacancy two excess electrons may be transferred to the neighbouring titanium atoms. To gain insight at the atomic scale, we have used high-resolution scanning tunnelling microscopy (STM) and photoelectron spectroscopy (PES) to study the nature of the defect state in the band gap of rutile TiO_2. The combination of these two experimental techniques revealed that the defect state in the band gap remains largely unaffected on TiO_2 surfaces when all oxygen vacancies have been removed. These results challenge the proposed traditional view.

Oxygen vacancies – or not

In previous work, we have identified oxygen vacancies on clean TiO_2 surfaces, where hydroxyl groups are formed on TiO_2 surfaces after water exposure, healing all the oxygen vacancies due to reactions of water molecules with the oxygen vacancies.

If a clean TiO_2 surface is exposed to oxygen, we find oxygen adatoms from dissociation of molecular oxygen on the oxide surface. Research so far has led to the belief that the dissociation of oxygen is only possible at the surface oxygen vacancies. However, our new experiments show that an additional dissociation channel exists leading to characteristic pairs of oxygen adatoms. This surprising result indicates that the importance of surface oxygen vacancies has been overestimated in the past.

We used photon emission spectroscopy to study both a clean TiO_2 surface with oxygen vacancies and a water exposed TiO_2 surface with hydroxyl groups. In the valence band spectra the only obvious difference is the OH feature at a binding energy of ~10.8 eV that is present only on the surface with hydroxyl groups. However, the defect state in the band gap is practically identical on these two TiO_2 surfaces. On the other hand, the defect state is strongly suppressed after high oxygen exposure both when starting from a clean TiO_2 surface and from a TiO_2 surface with hydroxyl groups.

Charge transfer from titanium ions

In the literature, the suppression of the defect state after high oxygen exposure has been ascribed to the healing of oxygen vacancies. In fact, this is a simple and appealing model that has been accepted for years. However, the experimental results can also be explained by charge transfer from titanium ions on interstitial sites in the near-surface region to oxygen adatoms on the surface. These titanium ions serve as electron donors.

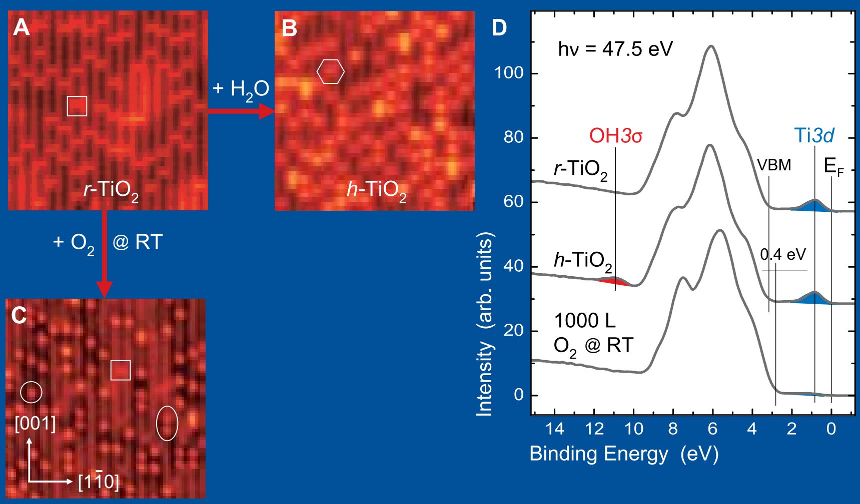
All our experimental results can be explained if titanium interstitials in the near-surface region cause the gap state, as we also show by density functional theory calculations. In the absence of oxygen vacancies on the surface, bulk-reduced TiO_2 thus remains highly reactive for redox reactions, since the titanium interstitials provide the charge necessary for O_2 adsorption and dissociation. In contrast, the traditional model suggesting that the healing of oxygen vacancies fails to explain why the defect state is not altered on a TiO_2 surface with hydroxyl groups. Furthermore, within the traditional model the additional oxygen dissociation channel that leads to the characteristic pairs of oxygen adatoms is difficult to explain.

Designing improved catalysts

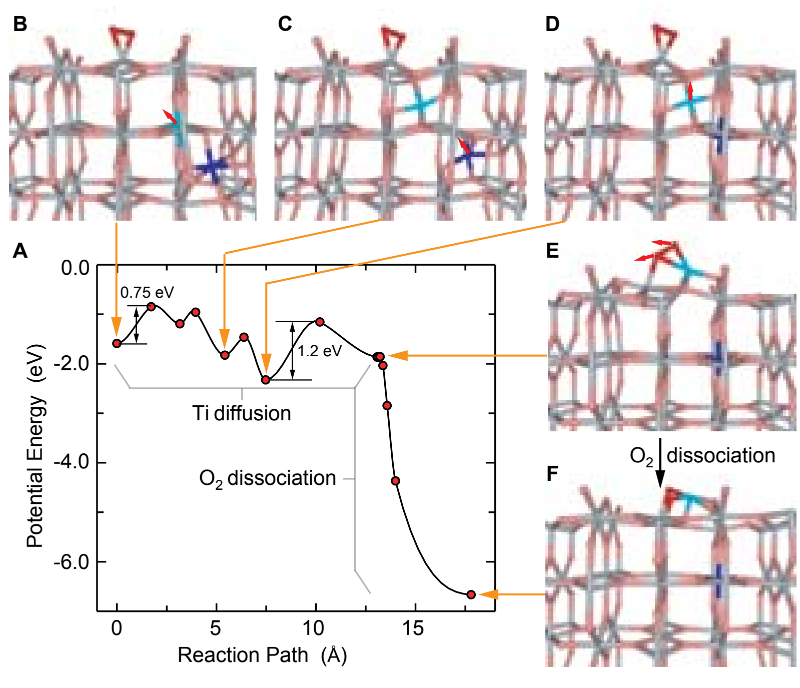
Our results are important not only from a fundamental point of view, but they also offer explanations about TiO_2 surface systems that are more applied in nature such as helping to design improved catalysts.

Two very important examples are the photo-catalytic activity of TiO_2 and the light-induced formation of water hydrophilicity on titania films. Specifically, in these examples, the aqueous environment precludes the existence of surface oxygen vacancies, and therefore titanium interstitials in the near-surface region are a much more realistic explanation than oxygen vacancies. Similarly, the catalytic activity of gold nanoparticles supported on TiO_2 at low temperatures, for instance in relation to CO oxidation, may now be better understood.

S. Wendt, P.T. Sprunger, E. Lira, G.K.H. Madsen, Z. Li, J.Ø. Hansen, J. Matthiesen, A. Blekinge-Rasmussen, E. Lægsgaard, B. Hammer, and F. Besenbacher, The Role of Interstitial Sites in the Ti3d Defect State in the Band Gap of Titania. Science 320, 1755 (2008).

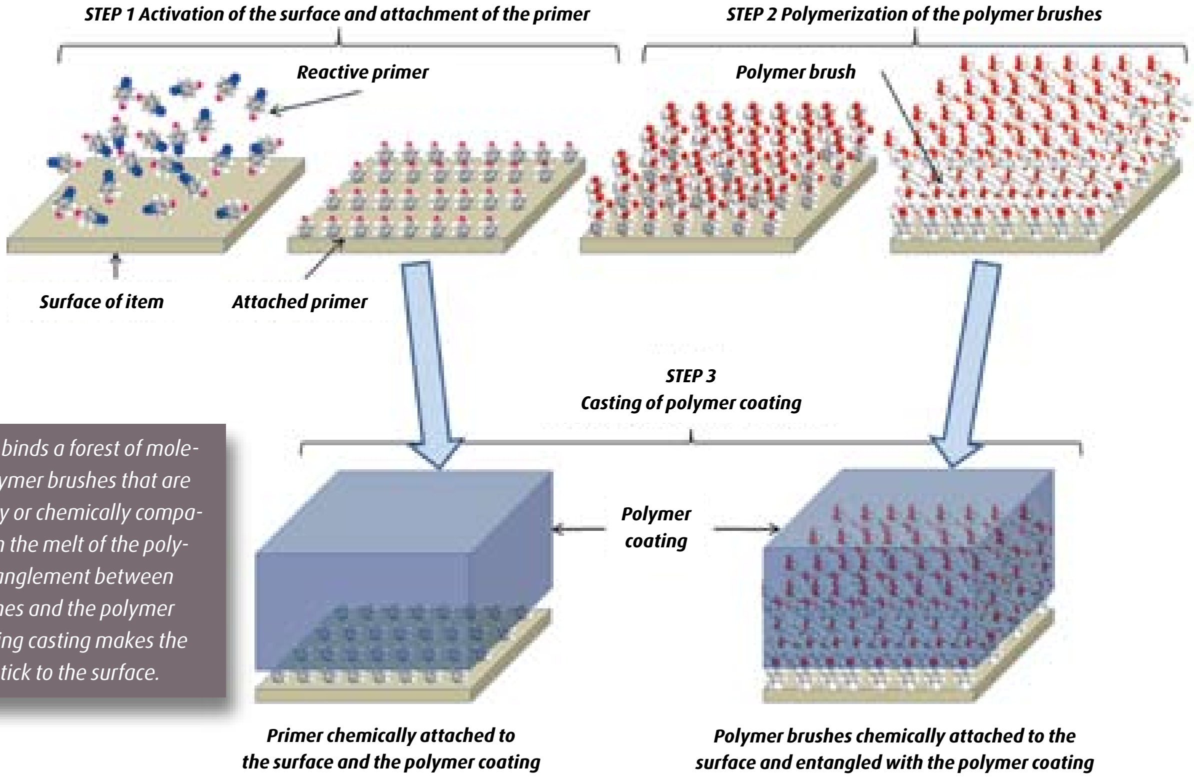


STM images of a reduced TiO_2 surface with oxygen vacancies (A), a surface with hydroxyl groups after water exposure (B), and a surface after high oxygen exposure (C). The corresponding PES valence band spectra are shown in (D). The defect state (Ti3d) is observed both on the reduced surface and the water exposed surface even though from the latter all oxygen vacancies have been removed.



Potential-energy profile for the reaction of an adsorbed O_2 molecule and a Ti interstitial (A). The O_2 molecule (red) is adsorbed (B). A Ti interstitial (dark blue) moves to an octahedral site toward the surface and a lattice Ti (light blue) moves to an octahedral site between the first and the second TiO_2 layer (C). The original Ti interstitial is now on a lattice site (D). The exchanged Ti interstitial appears at the surface (E). Adsorbed O_2 dissociates and forms a surface TiO_2 island on the terrace (F).

Towards durable surface coatings



A primer binds a forest of molecular polymer brushes that are physically or chemically compatible with the melt of the polymer. Entanglement between the brushes and the polymer melt during casting makes the coating stick to the surface.

Through carefully designed organic surface chemistry and advanced grafting techniques, it will be possible to modify the surface of a given item to obtain a protective polymer coating that attaches so strongly to the surface that it can withstand extreme physical and chemical environments.

By Mogens Hinge, Steen Uttrup Pedersen, Peter Kingshott and Kim Daasbjerg

We are surrounded by polymer-coated surfaces; the paint on the walls, the non-stick coating on our frying pans, and the easy-to-clean surface of a wooden kitchen table. Such coatings are applied in order to protect the underlying material, to cast the final shape, or to provide a surface with specific properties. New methods based on surface chemistry may lead to superior polymer coatings of consumer goods and industrial tools.

When coating an item the method of choice depends heavily on the physical and chemical properties of the surface, in particular the required attachment strength of the polymer coating. Today attachment is mostly achieved through mechanical interlocking or physical adhesion, but unfortunately, such forces can be too weak leading to poor attachment of the coating. Thus the coating cannot withstand the environment for which the product is intended. Therefore, the manufacturing industry seeks new and versatile solutions.

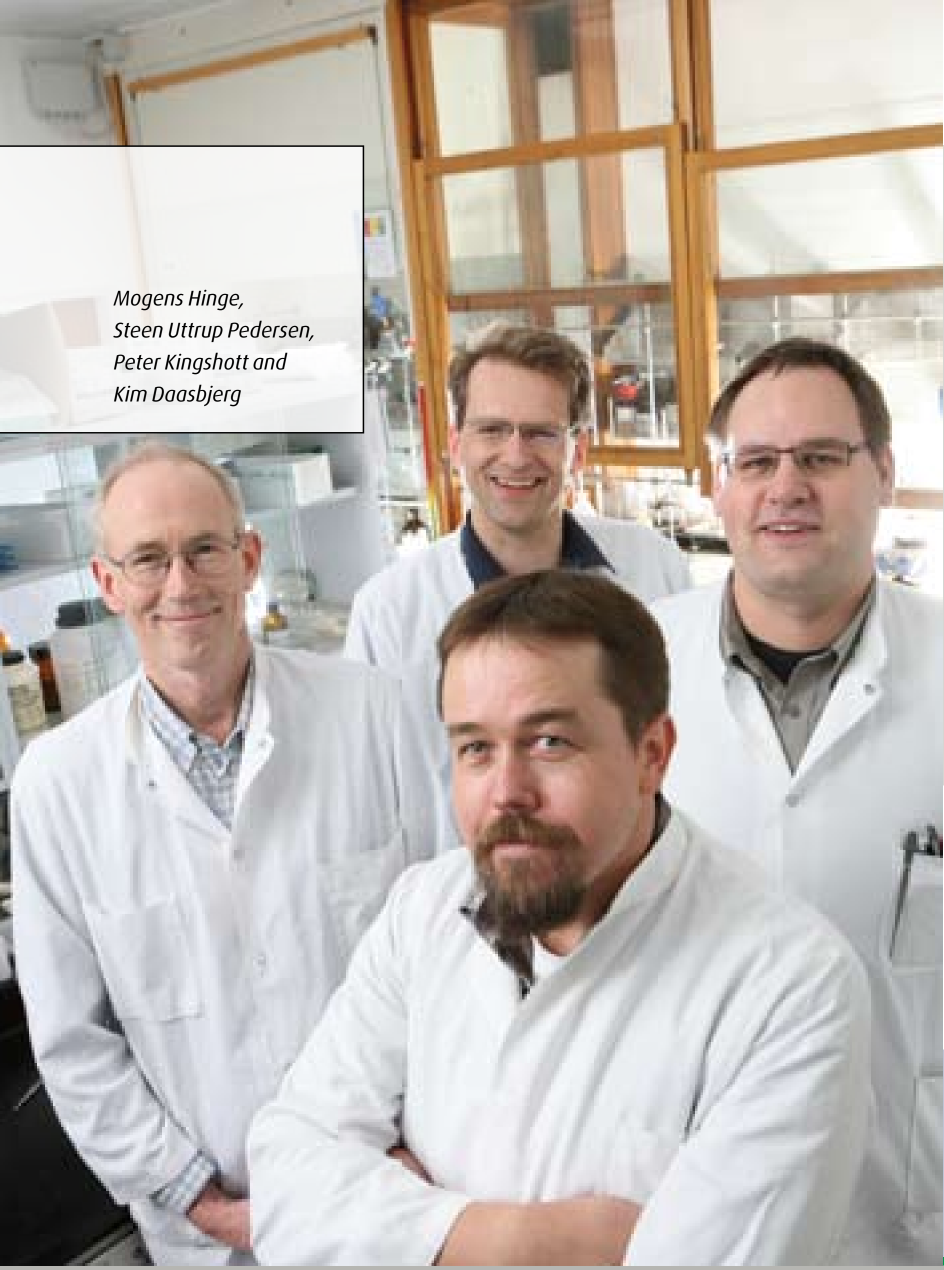
A keyword in this respect is chemisorption – that is the creation of strong chemical bonds between two otherwise incompatible materials. This is by no means a trivial task and requires fundamental knowledge about surface chemistry- and approaches for modifying and directing the chemical reactivity of surfaces.

The RadiSurf Project

The goal of the RadiSurf project at iNANO is to develop methods to generate strong chemical bonds between polymer coatings and various surfaces. This is particularly important for items made of industrial metals such as iron and stainless steel as well as for commodity and engineering plastics.

The basic idea is to modify the surface chemically with a primer that is either reactive towards or compatible with the polymeric matrix of the coating. After laboratory testing the primers are optimized and eventually implemented into industrial processes.

The RadiSurf project will contribute significantly to the development of future coating solutions for corrosion protection, reduction of wear, and cheaper maintenance. The research is carried out in close collaboration with two industrial partners: Grundfos, one of the world's leading pump manufacturers, and SP-Group that produces moulded plastic components and polymer coatings in Denmark, Poland, and China.

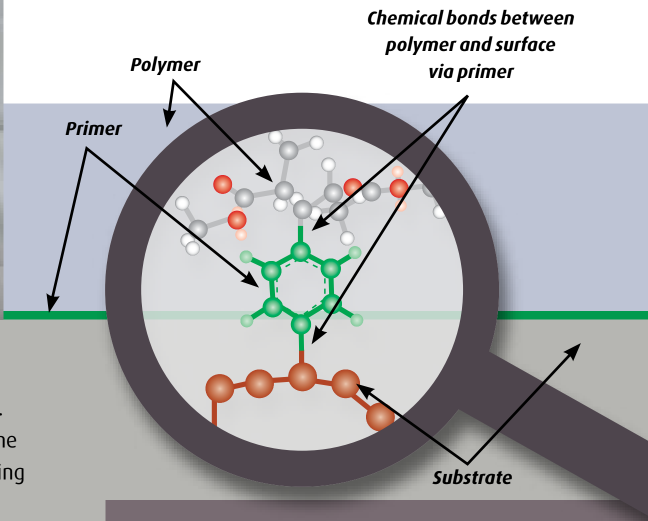


Mogens Hinge,
Steen Uttrup Pedersen,
Peter Kingshott and
Kim Daasbjerg

Surface coatings can change the properties of a surface; e.g. make it less water repelling. This can be desirable for coatings of industrial tools with water contact.

An uncoated surface repels a water drop

The same surface coated with a primer becomes less water repelling



A primer enables the formation of covalent bonds between a surface and a coating leading to a very strong attachment.

Attachment of primers to surfaces

In the case of conducting materials such as metals, the initial activation of the surface can be accomplished electrochemically by applying an electric potential to the surface. In this manner, an inert surface can become strongly oxidizing or reducing, depending on the potential applied. This facilitates the creation of covalent bonds to a primer. The primer should contain not only a group that is electrochemically reactive towards the surface, but also a functional group, which is compatible with the coating to be applied. For non-conducting materials such as plastics, the initial activation of the surface is accomplished by plasma activation methods followed by a chemical reaction with an appropriately designed primer. Both processes are easy to scale-up for our industrial partners.

The strength of the chemical bond between the surface and the primer is of crucial importance, because this bond has to withstand large thermal variations during the manufacturing process. Our results based on infrared measurements show that bond stability up to at least 250°C on metal surfaces can be achieved. Future research will focus on improving the thermal properties by chemically modifying the primer.

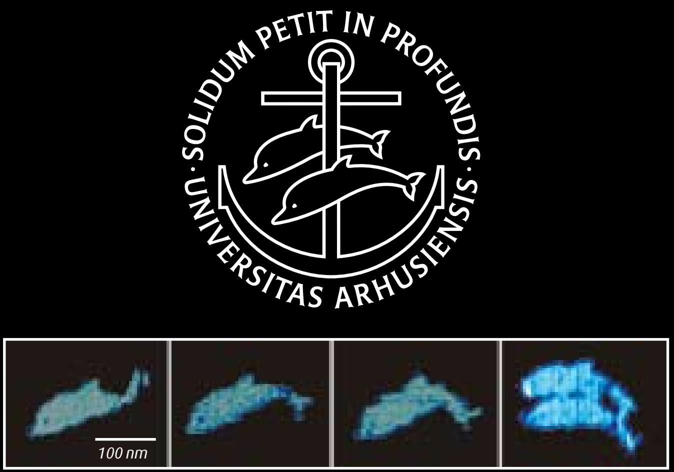
Attachment of polymers to primers

The next step is to produce a durable bond between the primer and the polymer coating. The most promising pathway is to use chemically reactive primers that form covalent bonds to the polymer directly during casting.

Alternatively, the necessary reactivity of the primer can be accomplished by synthesizing a forest of polymer brushes that are chemically and physically compatible with a melt of the polymer. The resulting entanglement between the brushes and the polymer melt casted onto the surface during industrial moulding is sufficiently large to ensure an overall strong bonding. The design of suitable brush candidates is challenging, because it depends strongly on the exact chemical properties of the final polymer coating.

Based on experiments, theory and simulations we aim to develop models to predict the best candidate primers for the most commonly used polymer systems. Before implementation, the industrial partners will put the modified surfaces through thorough long-term as well as accelerated mechanical and chemical tests. Passing these tests will ensure that the new generation of coatings maintains the required adhesion and protective properties even when they are exposed to extreme thermal fluctuations and aggressive chemical environments.

Design and self-assembly of DNA nanostructures



Left: The former logo of Aarhus University. Right: The dolphins of the logo have been reproduced at the nanoscale by designing 216 unique DNA sequences that were synthesized, mixed in the laboratory, and allowed to self-assemble into the shape of the dolphins.

The DNA double helix has recently been recognized as a promising system for fabricating complex nano-devices in a bottom-up approach. At iNANO we have developed soft-ware tools to design nanoscale objects by folding DNA into the desired shapes quickly and easily. We are also able to manipulate these nanostructures and investigate their dynamical properties.

By Ebbe Sloth Andersen and Mingdong Dong

Nanoscientists around the world have produced a lot of advanced building blocks for devices such as nanochips, biosensors, catalysts, nanomachines, diagnostic kits, and drug delivery systems, but a severe bottleneck for industrial application is the lack of efficient and cheap methods to assemble these building blocks into functional devices using a bottom-up approach. Fortunately, the unique properties of the DNA double helix - discovered more than 50 years ago – may come to the rescue.

The Centre for DNA nanotechnology (CDNA) is based at iNANO and is dedicated to exploring DNA as a programmable tool for assembling molecules and materials. It utilizes the basic principle that two DNA strands with complementary base sequences will find each other in solution and form the double helix. If the two DNA strands have functional groups attached, these will be brought together for a specific action to take place. However, artificial DNA structures can be designed to be much more complex than the double helix itself by connecting helices into networks by several crossovers. In this way diverse and rigid structures can be obtained by self-assembly; just as if your LEGO bricks at home would arrange themselves into the shape of the Eiffel Tower.

Recently, the revolutionary "DNA origami" method was developed by Paul W. Rothemund from the California Institute of Technology in the USA. This method is named after the Japanese art of paper folding, because it folds one long single-stranded DNA into a predefined shape by the action of multiple short DNA strands. The long DNA strand is extracted from a natural source - a virus that infects and kills bacteria - and it has a unique sequence that makes it possible to build DNA origami structures with arbitrary shapes and dimensions of approximately 100 x 100 square nanometres. Furthermore, this unique sequence gives each short DNA strand a unique address, which can be used to position 200 different objects with 6 nanometre resolution on the assembled structure. In Paul W. Rothemund's initial study, these properties were demonstrated by the construction of DNA objects with shapes of a smiley face, a nanoscale world map, and larger complexes in beautiful symmetrical patterns.

Automated design by computer

The design of DNA origami structures is a complex task involving the determination of more than 200 unique sequences that interact with the long DNA strand in more than 600 different places to define a unique structure. This type of task is clearly not suited for human impatience and is greatly facilitated by using appropriate computer software.

At iNANO we have developed a new software package that automates the design procedure, so that any graphical shape can be translated pixel-by-pixel into a similar DNA shape. As an initial demonstration of the software, the dolphins from the former logo of Aarhus University were designed in DNA. Making the dolphins involved the design of 216 unique DNA pieces which we subsequently synthesized, mixed with the long DNA strand in the laboratory, and allowed to self-assemble into the desired two-dimensional dolphin shape by simply heating and slowly cooling the sample.

Manipulating flexible DNA structures

To confirm that the DNA pieces self-assemble into the desired shape, an atomic force microscopy (AFM) scanning was performed and DNA dolphins were indeed observed. They measured just 200 nanometres, the equivalent of a hundredth of the width of a human hair.

It was also demonstrated that these dolphins could be designed with flexible tails and be assembled in pairs in a constellation resembling the logo. The flexibility of the dolphin tail depends on a particular design of the tail region, and with the AFM tip we could flip the tails of the nanoscale DNA dolphins. These types of studies can be further explored to develop design principles for the construction of nanomechanical devices with rigid and flexible DNA regions.

A new platform technology

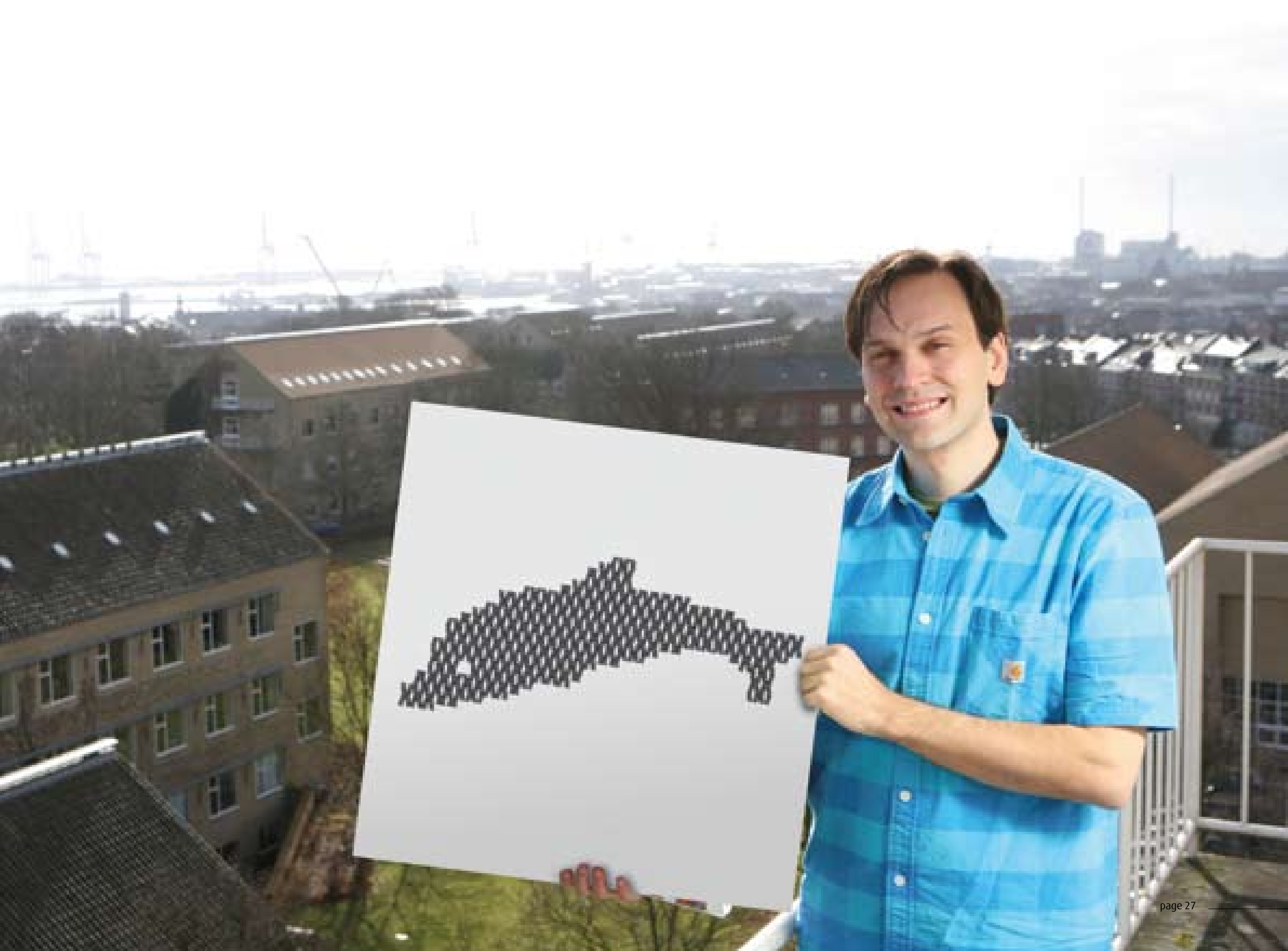
The DNA origami method provides a programmable and efficiently self-assembling scaffold that can be developed to gain control at the nanoscale. The possible applications are numerous, highlighted by several published studies applying this technique in diverse areas. A main application so far has been to position nanomaterials with high precision, but the method has also been utilized to detect cancer signals from cells and for interaction with electrodes.

DNA origami provides a platform technology with possible applications in nanoelectronics, chemistry, biosensing, and nanomedicine. Since the dolphin study we have been working on extending the origami technique to 3-D structures.

Software is available at: www.cdna.dk/origami

Above: Mingdong Dong in the laboratory.
Below: Ebbe Sloth Andersen.

Andersen ES, Dong M, Nielsen M, Jahn K, Thomsen AL, Mamdouh W, Gothelf K, Besenbacher F, Kjems J. DNA Origami Design of Dolphin-Shaped Structures with Flexible Tails. J. ACS Nano, 2008.



Biosensing with nucleic acids

– approaching single molecule detection

Elena Ferapontova

We aim at the development of advanced nanoscale nucleic acid biosensors capable of a fast single molecule analysis of cancer biomarkers, neurotransmitters and food pathogens. These biosensors will be valuable both in terms of nanotechnological and commercial applications.

By Elena Ferapontova

Biosensors play a vital role in medicine, the food industry, and for environmental surveys, providing routine analysis, crucial monitoring, and early detection of problems and crisis points. Not surprisingly, the world market for biosensors grows continuously. In 2008 the turnover approached 11 billion dollars; biomedical clinical testing contributing the most.

A biosensor consists of a biologically sensitive layer - enzymes, antibodies, nucleic acids, tissues, or microorganisms - which is conjugated with a physicochemical component serving as transducer and detector. The specific recognition interaction between the target analyte and the biosensitive layer is transformed by the transducer into a useful optical, piezoelectrical, or electrochemical signal, while the associated electronics or signal processors display the results in a user-friendly way.

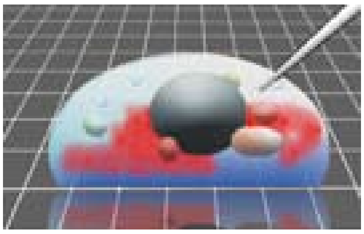
At iNANO we develop new electrochemical biosensor technologies for analysis of cancer biomarkers, pathogens, neurotransmitters, and drug brain metabolism, which are crucial for efficient diagnostics of cancer and infectious diseases, as well as for understanding and treatment of Parkinson's disease, depression, dystonia, alcoholism or pain.

Commercially attractive biosensors

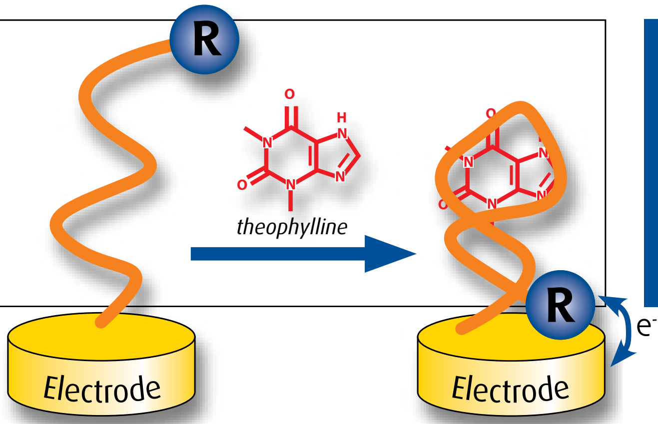
Our objective is to develop commercially attractive nucleic acid biosensors, which can provide the analytically required attomolar sensitivity for detecting analyte biomarkers, and for that purpose we use small, functional DNA and RNA nanoblocks to create molecular assemblies with improved structural and biosensing properties. By combining electrochemistry and DNA nanotechnology we develop extremely sensitive and accurate, yet simple, inexpensive and robust gene-based sensing platforms. At present, the DNA technologies developed at iNANO allow specific detection of 200 molecules of bacterial DNA in a 1 µl sample, and we aim at a single-molecule detection level.

Selective recognition

In our research, we design and study complex, electrochemically-labelled nucleic acid architectures that undergo distinct structural changes at



A nanoscale biosensor penetrates the living cell. Visualization by Alex Ferapontov.



Schematic representation of the electrochemical RNA-aptamer biosensor for detection of theophylline. The sensor is labelled with a redox active probe (R). When theophylline binds to the aptamer, the probe is bent towards the electrode and upon contact current flows.

A Carlsberg Foundation research grant and a NABIIT project

In 2007 Elena Ferapontova started working as an Assistant Professor at the Danish National Research Foundation: Centre for DNA Nanotechnology (CDNA), Department of Chemistry and iNANO, in the area of DNA electrochemistry and biosensor development. Now she has been awarded a Carlsberg Foundation research grant to develop a new generation of electrochemical biosensors for cancer diagnostics based on nanoswitching DNA and RNA architectures. Together with Kurt Gothelf, CDNA, AU; Leif Østergaard, Center of Functionally Integrative Neuroscience (CFIN); Jørgen Kjems, Molecular Biology, AU, and Unisense A/S and Lundbeck A/S as industrial partners, she also plays a leading role in a Nabiit project on electrochemical aptamer biosensors for specific monitoring of neurotransmitters in the brain.

General scheme of a biosensor.

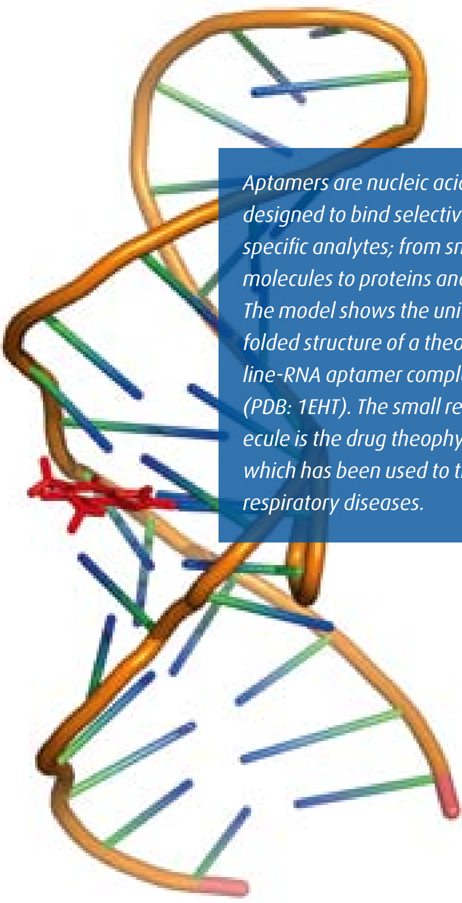
the electrodes triggered by chemical recognition of a specific DNA sequence or upon binding of other molecules of interest. In the latter case, we use aptamers, which are nucleic acids designed to selectively bind to certain analytes; from small molecules to proteins and cells. Their molecular recognition properties are unique, and they can be engineered completely in a test tube and are readily synthetically available.

A fine example is our electrochemical biosensor for detection of small-molecule drug theophylline in serum, where conformational transitions of the aptamer upon ligand binding are detected electrochemically through the changing response from a redox probe, placed closer to the electrode surface in the theophylline-aptamer complex.

With this type of nucleic acid biosensors we target protein and genetic biomarkers of cancer and small molecule neurotransmitters. Further, we plan to integrate aptamer electrodes for neurotransmitters in a needle-type microelectrode device, which can be inserted into the brain of animals and selectively, sensitively and timely measure individual neurotransmitters, such as dopamine and serotonin, in their nanomolar concentrations. Obtained information on brain neurotransmission is crucial for understanding and treatment of abnormal neurological conditions.

Nanobiosensors for early diagnostics

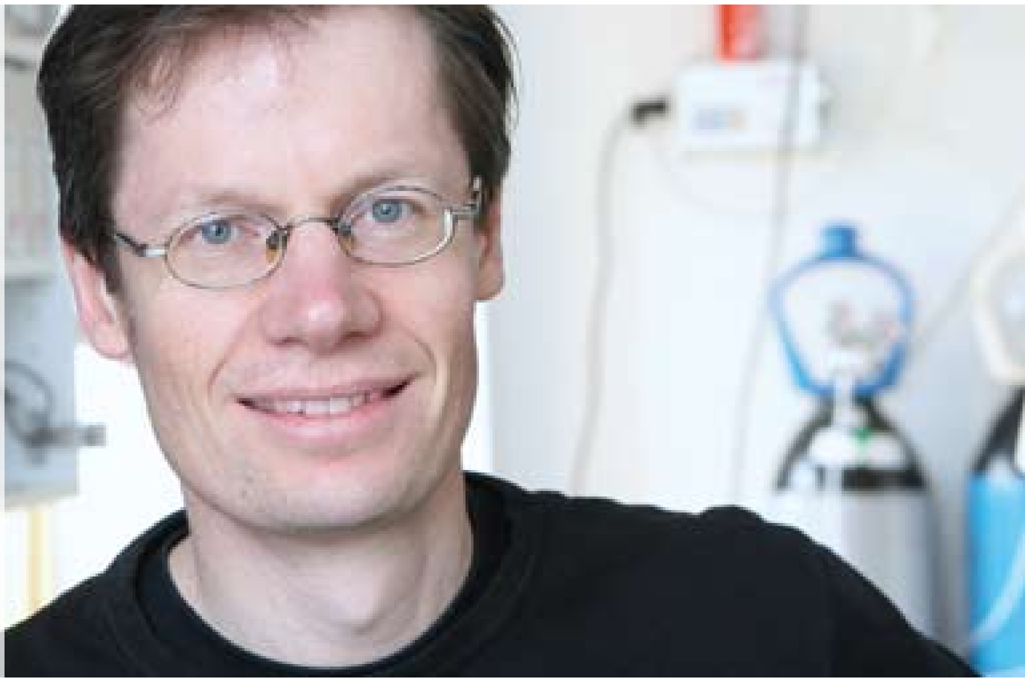
In perspective, we aim to develop nanoscale biosensors that may selectively capture cancer biomarkers, proteins, or small molecule messengers within a single living cell without destroying it: The metabolic function of healthy cells is distinct from that of sick cells, in which disease biomarkers can be directly identified. Diagnostics in submicron-sized objects as cells or single-molecule analysis in micro-litre to nano-litre samples require true nanoscale biosensors and such nanobiosensors can also provide information on how cells react when they are treated with a drug or invaded by a biological pathogen. The ultimate goal of our nanobiosensor research is to identify disease at the earliest stage possible, ideally at the level of a single cell or multiple cells of cancer stages, with advanced sensitivity, specificity, and reliability.



Aptamers are nucleic acids designed to bind selectively to specific analytes; from small molecules to proteins and cells. The model shows the unique folded structure of a theophylline-RNA aptamer complex (PDB: 1EHT). The small red molecule is the drug theophylline, which has been used to treat respiratory diseases.

Antimicrobial peptides:

Send the Marines and don't get friendly with the enemy



When pathogenic bacteria invade our bodies, an arsenal of small peptides goes for the bacterial cell membrane and punctures it. Elucidating how antimicrobial peptides kill bacteria may lead to new antibiotics based on novel nanoscale attack strategies.

By Daniel Otzen

When it comes to defence strategies, nothing supersedes the human body. We have a staggering array of weapons for fending off intruders such as fungi and bacteria that invade our bodies. The first line of defence is antimicrobial peptides (AMPs); a large and varied group of peptides which go for the bacterial jugular – the cell membrane – and in a time of rising bacterial resistance to common antibiotics AMPs attract world-wide attention as robust alternatives. While traditional antibiotics target specific receptors making it relatively easy for bacteria to mutate a single or a few receptor building genes, an attack on the cell membrane is more difficult to circumvent because a lot of genes are involved in its making.

The cell membrane consists mainly of fat molecules called phospholipids and when a bacterial cell membrane is punctured by AMPs the intruder dies. However, if antimicrobial peptides are to be utilized as antibiotics it is mandatory that they target only bacteria and stay clear of human cells. Fortunately, bacterial membranes tend to contain lipids with a higher amount of negative charge than mammalian cells and thus many AMPs have an overweight of positive charge making them quite specific for these microorganisms.

Encountering the cell membrane

To get a better understanding of how AMPs work, we have studied a peptide called Novicidin, which has been developed by Novozymes A/S based on a part of a larger AMP found in sheep. Novicidin has shown promise as an antibacterial peptide, but it still has some activity towards human red blood cells.

We are particularly interested in finding out how Novicidin binds to membranes. The simplest possibilities are either to be inserted in a transmembrane fashion – setting up a pore passing right through the membrane - or to bind while lying in the membrane plane. The outcome is determined by how stable the Novicidin peptides are in the different structures, and this in turn depends on the kind of fat the cell membrane consists of.

Spying on AMPs in action

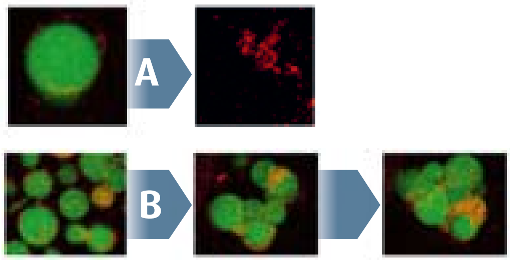
At iNANO we have a whole bouquet of different techniques to measure how Novicidin binds to cell membranes. For one thing, we use a spectroscopic approach called circular dichroism to determine whether Novicidin is in a stretched-out state or coiled up like an alpha-helix when binding. These experiments have provided clear information: If the membrane does not contain negatively charged lipids, then Novicidin remains stretched-out, whereas it coils up in the presence of negative charge.

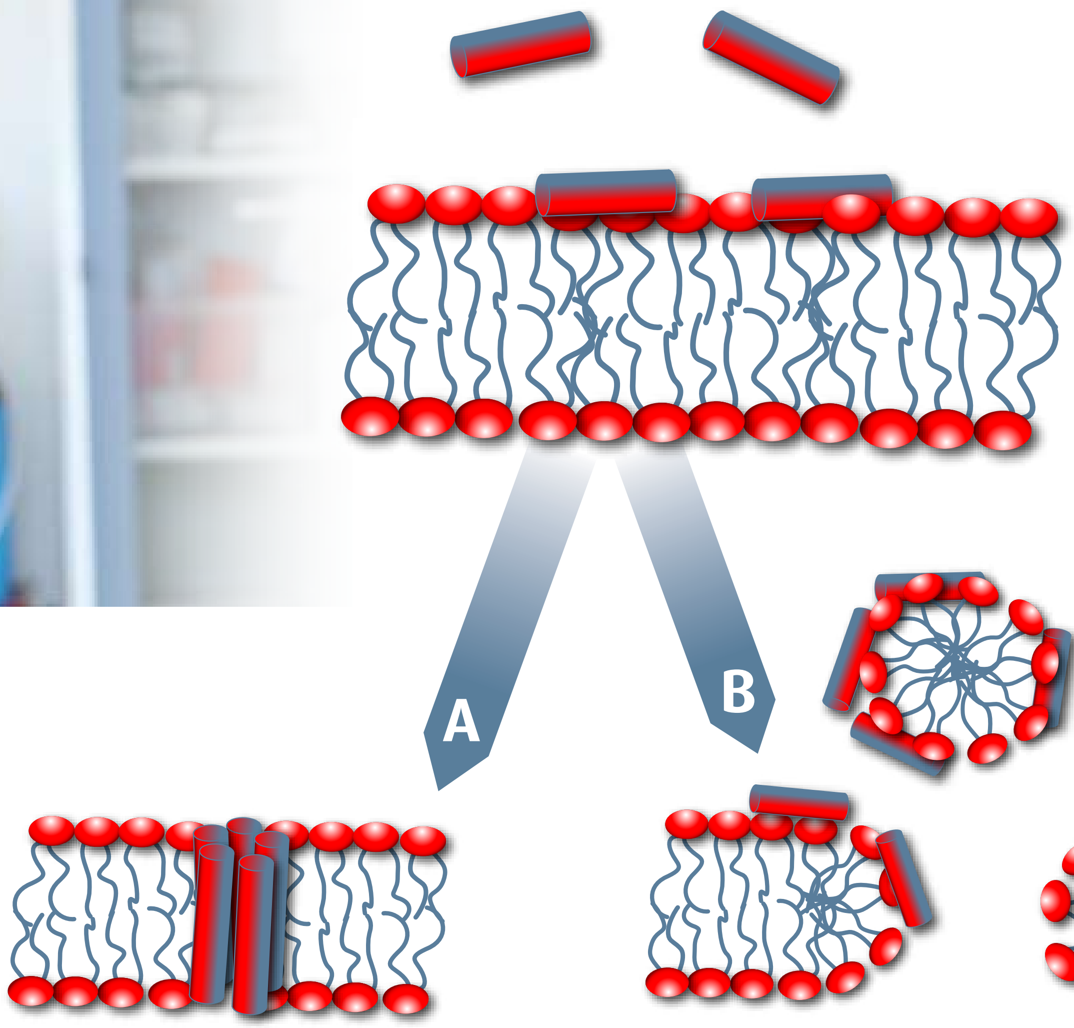
Does this mean that Novicidin is better at attacking negatively charged membranes than neutral ones? No, and that's the surprising part! It takes more than ten times as much Novicidin to punch holes through negative membranes than through neutral ones. This strange behaviour is seen even more clearly when we use a fast reaction technique called stopped-flow kinetics, in which we mix Novicidin with membranes within 5 milliseconds. These experiments show that Novicidin does not insert itself deeply into a neutral membrane in contrast to a negative membrane. Nevertheless, the neutral membrane leaks much faster than the negative one.

Avoid fraternization

Thus, like a good Marine, it does not pay for Novicidin to fraternize with the enemy. The peptide must attach lightly on the surface to be most efficient. This point is brought home even stronger when we make Novicidin stickier by

Novicidin is by far most efficient in puncturing cell membranes when it binds lightly to the surface rather than penetrating the membrane. This has been demonstrated using giant vesicles as a model. A) Surface binding leads to vesicle rupture. B) When the Novicidin peptide is equipped with a fat chain that inserts itself deeply into the membrane the vesicles fuse instead of being destroyed.





Two ways AMPs may bind to bacterial cell membranes: A) Several peptides form a pore across the membrane. B) The peptides attach to the surface along the plane of the membrane.

attaching fat chains of varying length to the peptide. The longer the chain, the more deeply it inserts into the membrane and the less the membrane leaks. This has been shown by solid state NMR experiments.

We can witness the whole battle at close hand using confocal laser scanning microscopy in giant unilamellar vesicles, which are big enough to be seen in the microscope. In this way, we have observed that Novicidin dissolves neutral vesicles whereas "sticky" Novicidin makes vesicles fuse.

A nanoscale attack strategy

What use are our observations? They show that some peptides actually prefer binding to neutral vesicles despite their positive charge – simply because too close an attachment traps them in a certain state that makes them less efficient towards negative membranes. This could mean that if we want to design more efficient AMPs, we should go for peptides that do not insert themselves deeply into the membrane.

The work described here is based on a close collaboration between four iNANO research groups headed by Daniel Otzen, Jan Johannes Enghild, Troels Skrydstrup and Niels Chr. Nielsen. Niels Chr. Nielsen heads the Danish Research Foundation center inSPIN which coordinates these - and many other - activities.

The experiments have been carried out by a team of talented students and postdocs including Brian Vad, Kresten Berthelsen, Line Aagot Thomsen, Magnus Franzmann, Zuzana Valnickova, Jan Mondrup Pedersen and Associate Professor Thomas Vosegaard and Reinhard Wimmer.

iNANO and industry

Chairman's statement

iNANO has continued to fulfil our ambitious expectations and in 2008 it has developed its portfolio of activities within research, education and innovation in a most satisfactory manner. By now, iNANO has established itself as a leading nanoscience and nanotechnology activity on the national as well as the international scale.

Details about iNANO's activities during the past year are presented throughout this report, and at this point I will restrict myself to mention a few highlights. Firstly, iNANO researchers secured substantial funding for research activities within nanoscience. As a prominent example the Director of iNANO, Flemming Besenbacher, was one of two Danes who obtained one of the prestigious ERC Advanced Grants for research. Secondly, the graduate school, iNANOschool, continues to grow at an impressive rate reaching a total of 123 enrolled PhD students at the year's end. Thirdly, we have witnessed a steadily increasing focus on iNANO's innovation activities and collaboration with industrial partners. The Board warmly welcomes these initiatives and participates actively in the continuing discussion on how to strengthen them. Finally, the board is pleased to note that iNANO's outreach activities for e.g. high schools and the general public have also been strengthened substantially. Such activities are important not only to improve the knowledge level generally, but also to secure sufficient recruitment of talented new students in a very competitive market.

Although the public funding for research in general has increased substantially over the past few years, it is disappointing that research within nanoscience continues to receive little support in Denmark compared with the level in other developed countries. This fact seriously hampers our efforts to secure that Denmark will receive full benefit from an emerging cutting-edge technology. iNANO researchers are forced to spend too much valuable time writing too many applications, just to receive too small grants. We can only hope that funding agencies will reconsider their current prioritisation and instead will allocate substantial funds for research in nanoscience.

I wish to thank my colleagues on the iNANO board for their active and dedicated contribution during the past year, and I look forward to continuing our collaboration in 2009. Finally, I wish to congratulate the iNANO staff for their excellent performance in 2008. As a result of their dedicated and hard work, I am confident that 2009 will be another very good year for nanoscience and nanotechnology in Aarhus.

Hans Jørgen Pedersen
CEO of Danfoss Bionics A/S
Chairman of the iNANO board

Industrial collaborators

Aalborg Portland Group, Denmark
AarhusKarlshamn A/S, Denmark
Alfa Laval Kolding, Denmark
Alfa Laval Lund, Sweden
Alfa Laval Nakskov A/S, Denmark
ALK-Abelló A/S, Denmark
Arla Foods amba, Denmark
AstraZeneca, United Kingdom
Atlantic Biotech, Faroe Islands
Bang & Olufsen A/S, Denmark
Beneq Oy, Finland
Biocompatibles, UK
Biomodics, Denmark
Bioneer, Denmark
Capres A/S, Denmark
Carlsberg Research Center, Denmark
CemeCon Scandinavia, Denmark
CeNTect GmbH, Germany
Chew Tech I/S, Denmark
Chr. Hansen A/S, Denmark
CLC-Bio A/S, Denmark
Coloplast Research A/S, Denmark
Danfoss A/S, Denmark
Danfoss Bionics, Denmark
Danfoss PolyPower A/S, Denmark
Danisco A/S, Denmark
Danish Genome Institute, Denmark
Danish Technological Institute, Denmark
Dantherm A/S, Denmark
Diramo, Denmark
Dyrup A/S, Denmark
FeF Chemicals A/S, Denmark
Fertin Pharma, Denmark
Fibertex, Denmark
FLSmidth A/S, Denmark
Fresenius Kabi AG, Germany
GPV Group, Denmark
Gram Commercial A/S, Denmark
Gram Equipment A/S, Denmark
Grundfos A/S, Denmark
H2 Logic ApS, Denmark
Haldor Topsøe A/S, Denmark
IBSEN Photonics A/S, Denmark
Ignis Photonyx A/S, Denmark
Image Metrology, Denmark
Innoscan, Denmark
Institute of Photonic Technology, Germany
Integrated DNA Technologies, USA
IMEC,Belgium
JPK Instruments, Germany
KinaseDetect ApS, Denmark
Koheras, Denmark
LeoPharma A/S, Denmark
Lundbeck A/S, Denmark
LU-VE S.p.A, Italy
Macrozymes, The Netherlands
Mankiewicz Gebr. & Co KG, Germany
Merck & Co, USA
Merck Serono International, Switzerland
Molegro ApS, Denmark

MSC-Technology, Denmark
Nanon A/S, Denmark
NanoNord A/S, Denmark
NIL Technology, Denmark
Nilan A/S, Denmark
NKT Research & Innovation A/S, Denmark
Novo Nordisk A/S, Denmark
Novozymes, Denmark
OFS Fitel Denmark A/S, Denmark
Oticon, Denmark
PANCO, Germany
Pepscan Therapeutics, The Netherlands
Pipeline Biotech A/S, Denmark
PolyPlus-transfection, France
Profos AG, Germany
Q-sense AB, Sweden
RAcell Solar A/S, Denmark
Regulon Inc, Greece
Rho-BeSt Coating plc, Germany
RiboTask ApS, Denmark

RiNA GmbH, Germany
Rockwool, Denmark
Sanofi-Aventis, Germany
Santaris Pharma A/S, Denmark
SCF Technologies, Denmark
SP Group A/S, Denmark
SPECS, Germany
Stensborg A/S, Denmark
Systematic Software Engineering A/S, Denmark
The Imego Institute, Sweden
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Unisense A/S, Denmark
Varian Inc., USA
Veeco Instruments GmbH, Germany
Velux A/S, Denmark
Vestas Wind Systems A/S, Denmark
Vipergen, Denmark
Wyeth Discovery Research A/S, USA
Zgene, Denmark

Academic collaborators

Academic collaborators

Academic institutions with whom the senior staff at iNANO collaborate.

Aalborg University, Aalborg, Denmark
Advanced Photon Source, Chicago, USA
Antwerp University, Antwerp, Belgium
Aarhus University Hospital, Aarhus, Denmark
Arizona State University, Arizona, USA
Australian National University, Canberra, Australia
Beijing University, Beijing, China
Biomedical Sciences Research Center "Al. Fleming", Vari, Greece
Burke Medical Research Institute, New York, NY, USA
Center of Biostatistics and Bioinformatics, University of Rome, Rome, Italy
CECAM, Lyon, France
Centre National de la Recherche Scientifique, Toulouse, France
Centro Atomico Bariloche, San Carlos de Bariloche, Argentina
Chalmers University of Technology, Gothenburg, Sweden
CNRS, Orleans, France
CNR - IPCF, Pisa, Italy
Consiglio Nazionale delle Ricerche, Bologna, Italy
Cornell University, New York, NY, USA
CSIRO Molecular and Health Technologies, Melbourne, Australia
Dalian Institute of Chemical Physics, CAS, Dalian, China
Danish Cancer Society, Copenhagen, Denmark
Danish Institute for Fishery Research, Copenhagen, Denmark
Danish Institute for Food and Veterinary Research, Aarhus, Denmark
Danish Meat Research Institute, Slagelse, Denmark
Demokritos/IMEL, Athens, Greece
Donostia International Physics Center, Donostia/San Sebastian, Spain
Duke University, North Carolina, USA
Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland
ETH, Zurich, Switzerland
European Synchrotron Radiation Facility, Grenoble, France
Flinders University, Adelaide, Australia
Florida State University, Tallahassee, Florida, USA
FOM-AMOLF, Amsterdam, The Netherlands
Forschungszentrum Dresden-Rossendorf, Dresden, Germany
Forschungszentrum Karlsruhe GmbH, Karlsruhe, Germany
Fraunhofer IME, Munich, Germany
Freiburg University, Freiburg, Germany
Freie Universität Berlin, Berlin, Germany
French National Institute for Health and Medical Research, Paris, France
Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin, Germany
Fudan University, Shanghai, China
Geological Survey of Denmark and Greenland, Copenhagen, Denmark
German Aerospace, Cologne, Germany
GSF-Forschungszentrum Umwelt und Gesundheit Neuherberg, Neuherberg, Germany
Hannah Research Institute, Ayr, Scotland
Harvard Medical School, Boston, MA, USA
Harvard University, Cambridge, MA, USA
Hasylab, Hamburg, Germany
Helmholtz Center, Munich, Germany
Helsinki Technical University, Helsinki, Finland
Hokkaido University, Sapporo, Japan
Huazhong Normal University, Wuhan, China
Imperial College London, London, UK
Indian Institute of Science, Bangalore, India
Institut de Génétique Moléculaire de Montpellier, Montpellier, France
Institute for Energy Technology, Kjeller, Norway
Institute for Materials Research, Berlin, Germany
Institute for Solid State Research, Dresden, Germany
Institute for Solid State Research, Jülich, Germany
Institute of Chemistry, CAS, Beijing, China
Institute of High Energy Physics, CAS, Beijing, China
Institute of Physics, CAS, Beijing, China
Jagiellonian University, Krakow, Poland
Jet Propulsion Laboratory, Pasadena, CA, USA
Jilin University, Changchun, China
Johan Wolfgang Goethe University, Frankfurt, Germany
Karolinska Institutet, Stockholm, Sweden
Katholieke Universiteit Leuven, Leuven, Belgium
Laboratoire de Recherche sur les Polyméres, CNRS, Thiais, France
Lawrence Berkeley National Laboratory, Berkeley, CA, USA
Lehigh University, Bethlehem, PA, USA
Liebniz Institut für Pharmakologie, Berlin, Germany
Linköping University, Linköping, Sweden
Los Alamos National Lab., Los Alamos, NM, USA
Lund University, Lund, Sweden
Madurai Kamaraj University, Madurai, India
Max-Planck-Gesellschaft zur Förderung der Wissenschaften, Stuttgart, Germany
Max-Planck-Gesellschaft zur Förderung der Wissenschaften, Munich, Germany
Max-Planck-Institut für Mikrostrukturphysik, Halle, Germany
Max-Planck-Institute for Infection Biology, Berlin, Germany
Max-Planck-Institute for Solid State Research, Stuttgart, Germany
Max-Planck-Institute für Biophysikalische Chemie, Göttingen, Germany
Max-Planck-Institute, Dresden, Germany
McGill University, Montreal, Quebec, Canada
Melbourne University, Melbourne, Australia
MESA+ Institute for Nanotechnology, Enschede, The Netherlands
Monash University, Clayton Victoria, Australia
National Center for Nanoscience and Technology, Bejing, China
National Center for Molecular Imaging, Baylor College of Medicin, Houston, TX, USA
National High Magnetic Field Lab, Tallahassee, FL, USA
National Jewish Medical and Research Center, Denver, CO, USA
National Research Centre for the Working Environment, Copenhagen, Denmark
National Research Council, Ottawa, Canada
NCCR, Basel, Switzerland
New York University School of Medicine, New York, NY, USA
NIH, Bethesda, MD, USA

Northwestern University, Evanston, USA
Norwegian University of Life Science, Aas, Norway
Oak Ridge National Laboratory, Oak Ridge, TN, USA
Odense University Hospital, Odense, Denmark
Oregon Health and Science University, Portland, OR, USA
Oxford University, Oxford, UK
Pacific Northwest National Laboratory, Richland, WA, USA
Peking University, Beijing, China
Polish Academy of Sciences, Warsaw, Poland
Pondicherry Engineering College, Puducherry, India
Poul Scherrer Institute, Villigen, Switzerland
Rice University, Houston, TX, USA
Risø, Roskilde, Denmark
Roskilde University Center, Roskilde, Denmark
RWTH, Aachen, Germany
Rutgers University, NJ, USA
Sandia National Laboratories, Albuquerque, NM, USA
Shanghai University, Shanghai, China
Sincrotrone Trieste, Trieste, Italy
Swiss Federal School of Technology Zurich, Switzerland
Technical University Delft, Delft, The Netherlands
Technical University of Darmstadt, Darmstadt, Germany
Technical University of Denmark, Kgs. Lyngby, Denmark
Technical University of Munich, Munich, Germany
Texas A&M University, College Station, TX, USA
Texas Tech Health Sciences Center, Amarillo, TX, USA
The Forsyth Institute, Boston, MA, USA
The Ian Wark Research Institute, University of South Australia, Adelaide, Australia
The University of Edinburgh, Edinburgh, Scotland
Tianjin University, Tianjin, China
Tsinghua University, Beijing, China
UMDNJ - New Jersey Medical School, NJ, USA
Universidad Autónoma de Madrid, Madrid, Spain
Universidad de Valladolid, Valladolid, Spain
Universitat Autònoma de Barcelona, Barcelona, Spain
Universität Hannover, Hannover, Germany
Universität Osnabrück, Osnabrück, Germany
Université de la Mediterranee, Marseilles, France
Université du Québec, Montreal, Canada
Universiteit van Amsterdam, Amsterdam, The Netherlands
University of Nagoya, Nagoya, Japan
University of Alberta, Dept of Chemistry, Edmonton, Canada
University of Auckland, Auckland, New Zealand
University of Basel, Basel, Schwitzerland
Universitety of Bergen, Bergen, Norway
University of California, Riverside, CA, USA
University of California, San Francisco, CA, USA
University of California, Santa Barbara, CA, USA
University of Cambridge, Cambridge, UK
University of Cardiff, Cardiff, UK
University of Catania, Catania, Italy
University of Copenhagen, Copenhagen, Denmark
University of Essex, Colchester, UK
University of Florida, Gainesville, FL, USA
University of Ghent, Ghent, Belgium
University of Glasgow, Glasgow, Scotland
University of Goa, Goa, India
University of Gothenburg, Gothenburg, Sweden
University of Guelph, Guelph, Canada
University of Iceland, Reykjavik, Iceland
University of Illinois, Urbana-Champaign, IL, USA
University of Karlsruhe, Karlsruhe, Germany
University of Kiel, Kiel, Germany
University of Kuopio, Kuopio, Finland
University of La Plata, La Plata, Argentina
Université Laval, Québec, Canada
University of London, London, UK
University of Malmö, Malmö, Sweden
University of Manchester, UK
University Miguel Hernandez, Elche, Spain
University of Milan, Milan, Italy
University of New Hampshire, Durham, NC, USA
University of New South Wales, Sydney, Australia
University of Nottingham, Nottingham, UK
University of Oslo, Oslo, Norway
University of Padova, Padova, Italy
University of Parma, Parma, Italy
University of Pennsylvania, Philadelphia, PA, USA
University of Perugia, Italy
University of Pittsburgh, Pittsburgh, PA, USA
University of Queensland, Brisbane, Australia
University of Reading, Reading, UK
University of Rennes, Rennes, France
University of Rome "La Sapienza", Rome, Italy
University of Science and Technology of China, Hefei, China
University of Seville, Seville, Spain
University of Sheffield, Sheffield, UK
University of Southern California, Los Angeles, CA, USA
University of Southern Denmark, Odense, Denmark
University of Stockholm, Stockholm, Sweden
University of Sydney, Sydney, Australia
University of Tennessee, Knoxville, TN, USA
University of Texas at Austin, Austin, TX, USA
University of Turin, Turin, Italy
University of Toronto, Toronto, Canada
University of Tsukuba, Tsukuba, Japan
University of Ulster, Belfast, UK
University of Vienna, Vienna, Austria
University of Washington, Seattle, WA, USA
University of Western Australia, Perth, Australia
University of Western Ontario, London, Canada
Uppsala University, Uppsala, Sweden
Vanderbilt University School of Medicine, Nashville, TN, USA
Vienna University of Technology, Vienna, Austria
VTT Technical Research Centre of Finland, Espoo, Finland
Westfälische Wilhelms-Universität, Münster, Germany
Zhejiang University, Hangzhou, China
Zhejiang University of Technology, Hangzhou, China
Zurich Research Laboratory, Zurich, Switzerland

PhD theses

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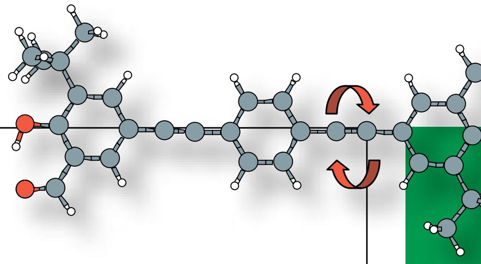


Publications

A 5' splice site enhances the recruitment of basal transcription initiation factors in vivo. Damgaard, CK, Kahns, S, Lykke-Andersen, S, Nielsen, AL, Jensen, TH, Kjems, J, I: Molecular Cell. 2008; vol. 29, no. 2, pp. 271-278

A complementary metal-oxide-semiconductor compatible monocantilever 12-point probe for conductivity measurements on the nanoscale. Gammelgaard, L, Bøggild, P, Wells, J, Handrup, K, Hofmann, P, Balslev, MB, Hansen, JE, Petersen, PRE, I: Applied Physics Letters. 2008; vol. 93, pp. 093104

A cyclic peptidylic inhibitor of murine urokinase-type plasminogen activator. Changing species specificity by substitution of a single residue. Andersen, LM, Wind, T, Hansen, HD, Andreasen, P, I: Biochemical Journal. 2008; vol. 412, pp. 447-457

A global study of myoglobin-surfactant interactions. Andersen, KK, Westh, P, Otzen, D, I: Langmuir. 2008; vol. 15, pp. 399-407

A ground-state directed optimization for the Kohn-Sham energy. Høst, S, Jansik, B, Olsen, J, Jørgensen, P, Reine, S, Helgaker, T, I: Physical Chemistry Chemical Physics. 2008; vol. 10, pp. 5344

A New Autocatalytic Activation Mechanism for Cysteine Proteases Revealed by Prevotella intermedia Interpain A. Mallorquí-Fernández, N, Manandhar, SP, Mallorquí-Fernández, G, Usón, I, Wawrzonek, K, Kantyka, T, Solà, M, Thøgersen, I, Enghild, JJ, Potempa, J, Gomis-Rüth, FX,. I: Journal of Biological Chemistry. 2008; vol. 283, Issue 5, pp.2871-2882

A new polymorph in the zinc phosphate Zn2(HPO4)3 family prepared with DABCO as structure-directing agent. Jensen, TR, Goncalves, A, Hazell, RG, Jakobsen, HJ, I: Microporous and Mesoporous Materials. 2008; vol. 109, pp. 383-391

A Novel Disulfide Switch Mechanism in Ero1a Balances ER Oxidation in Human Cells. Appenzeller-Herzog, C, Riemer, J, Christensen, B, Sørensen, ES, Ellgaard, L, I: EMBO Journal. 2008; vol. 27, pp. 2977-2987

A peptide accelerating the conversion of plasminogen activator inhibitor-1 to an inactive latent state. Andreasen, P, Mathiasen, L, Dupont, DM, Christensen, A, Blouse, G, Jensen, JK, Wind, T, Gils, A, Declerck, PJ, I: Molecular Pharmacology. 2008; vol. 74, no. 3, pp. 641-653

A reconstituted light-harvesting complex from the green sulfur bacterium Chlorobium tepidum containing CsmA and bacteriochlorophylla. Pedersen, MØ, Pham, L, Steensgaard, DB, Miller, M, I: Biochemistry. 2008; vol. 47, no. 5, pp. 1435-41

A role for neuroglobin: Resetting the trigger level for apoptosis in neuronal and retinal cells. Fago, A, Mathews, AJ, Brittain, T, I: IUBMB Life - A Journal of the International Union of Biochemistry and Molecular Biology. 2008; vol. 60, no. 6, pp. 398-401

A small-angle X-ray scattering study of aggregation and gelation of colloidal silica. Zackrisson, AS, Pedersen, JS, Bergenholtz, J, I: Colloids and Surfaces A: Physicochemical and Engineering Aspects. 2008; vol. 315, pp. 23-30

Ab initio study of structural and electronic properties and hyperfine interactions at the Ta nucleus in Ta-doped monoclinic HfO2. Alonso, RE, Errico, LA, Peltzer y Blancá, EL, López-García, A, Svane, A, Christensen, NE, I: Physical Review B. Condensed Matter and Materials Physics. 2008; vol. 78, pp. 165-206

Activation in Prochiral Reaction Assemblies on Pt(111). Laliberté, MA, Lavoie, S, Hammer, B, Mahieu, G, McBreen, PH, I: Journal of the American Chemical Society. 2008; no. 130, pp. 5386-5387

Adjuvant therapies of bone graft around non-cemented experimental orthopedic implants stereological methods and experiments in dogs. Baas, J, I: Acta Orthopaedica. Supplementum. 2008; vol. 79, no. 330, pp. 1-43

AFM-based force spectroscopy measurements of mature amyloid fibrils of the peptide glucagon. Dong, M, Hovgaard, MB, Mamdouh, W, Xu, S, Otzen, D, Besenbacher, F, I: Nanotechnology. 2008; vol. 19, pp. 384013

Aggregation of S6 in a quasi-native state by monomeric SDS. Otzen, D, Nesgaard, L, Andersen, KK, Hansen, JH, Christiansen, G, Doe, H, Sehgal, P, I: Biochimica et Biophysica Acta - Biomembranes. 2008; no. 1784, pp. 400-414

All solution processed tandem polymer solar cells based on thermocleavable materials. Hagemann, O, Bjerring, M, Nielsen, NC, Krebs, FC, I: Solar Energy Materials & Solar Cells. 2008; vol. 92, no. 11, pp. 1327-1335

Amyloid - a state in many guises: Survival of the fittest fibril fold. Pedersen, JS, Otzen, D, I: Protein Science. 2008; vol. 17, pp. 1-9

Amyloid-like adhesins in floc-forming and filamentous bacteria in activated sludge. Larsen, P, Nielsen, JL, Otzen, D, I: Applied and Environmental Microbiology. 2008; vol. 74, pp. 1517-1526

An atomic force microscopy study of the interactions between indolicidin and supported planar bilayers. Askou, HJ, Jakobsen, RN, Fojan, P, I: Journal of Nanoscience and Nanotechnology. 2008; vol. 8, no. 9, pp. 4360-4369

An efficient algorithm for solving nonlinear equations with a minimal number of trial vectors: Applications to atomic-orbital based coupled-cluster theory. Ziolkowski, M, Weijo, V, Jørgensen, P, Olsen, J, I: Journal of Chemical Physics. 2008; vol. 128; Issue 20, pp. 204105-204105-12

Publications

An Expedient Synthesis of the Fibril Binding Compound FSB via Sequential Pd-Catalyzed Coupling Reactions. Mantel, M, Søbjerg, LS, Huynh, THV, Ebran, JP, Lindhardt, AT, Nielsen, NC, Skrydstrup, T, I: Journal of Organic Chemistry. 2008; vol. 73, no. 9, pp. 3570–3573

An explanation for the high stability of polycarboxythiophenes in photovoltaic devices - A by solid-state NMR dipolar recoupling study. Bjerring, M, Nielsen, JS, Siu, A, Nielsen, NC, Krebs, FC, I: Solar Energy Materials & Solar Cells. 2008; vol. 92, pp. 772-784

An Investigation Into the Interactions Between Self-Assembled Adenine Molecules and a Au(111) Surface. Kelly, REA, Xu, W, Lukas, M, Otero Martin, R, Mura, M, Lee, YJ, Lægsgaard, E, Stensgaard, I, Kantorovich, LN, Besenbacher, F, I: Small. 2008; vol. 4, pp. 1494-1500

An RNA Aptamer-Based Electrochemical Biosensor for Detection of Theophylline in Serum. Ferapontova, EE, Olsen, EM, Gothelf, KV, I: Journal of the American Chemical Society. 2008; vol. 130, no. 13, pp. 4256-4258

Antifouling enzymes and the biochemistry of marine settlement. Kristensen, JB, Meyer, RL, Laursen, BS, Shipovskov, S, Besenbacher, F, Poulsen, CH, I: Biotechnology Advances. 2008; vol. 26, pp. 471-481

Application of Ynamides in the Synthesis of 2-Amidoindoles. Dooleweerdt, K, Ruhland, T, Skrydstrup, T, I: Organic Letters. 2008; vol. 11, no. 1, pp. 221-224

Assembly and structural analysis of a covalently closed nano-scale DNA cage. Andersen, FF, Knudsen, B, Oliveira, C, Frøhlich, RF, Krüger, D, Bungert, J, Agbandje-McKenna, M, McKenna, R, Veigaard, C, Juul, S, Koch, J, Rubinstein, JL, Guldbrandtsen, B, Hede, MS, Karlsson, G, Andersen, AH, Pedersen, JS, Knudsen, BR, I: Nucleic Acids Research. 2008 ; vol. 36(4), pp.1113-1119

Atomic Scale Kelvin Probe Force Microscopy Studies of the Surface Potential Variations on the TiO2(110) Surface. Enevoldsen, GH, Glätzel, T, Christensen, MC, Lauritsen, JV, Besenbacher, F, I: Physical Review Letters. 2008; vol. 100, pp.236104

Atomic-scale structure of Mo6S6 nanowires. Kibsgaard, J, Tuxen, AK, Levinsen, M, Lægsgaard, E, Gemming, S, Seifert, G, Lauritsen, JV, Besenbacher, F, I: Nano Letters. 2008; vol. 8, pp. 3928–3931

Atypical asymmetric lattice corneal dystrophy associated with a novel homozygous mutation (Val624Met) in the TGFBI gene. Afshari, NA, Bahadur, RP, Eifrig Jr, DE, Thøgersen, I, Enghild, JJ, Klintworth, GK, I: Molecular Vision. 2008; vol. 14, pp. 495-499

Avoided Crossing of Rattler Modes in Thermoelectric Materials. Christensen, M, Abrahamsen, AB, Christensen, NB, Juranyi, F, Andersen, NH, Lefmann, K, Andersson, J, Bahl, CRH, Iversen, BB, I: Nature Materials. 2008; vol. 7, pp. 811-815

Background Removal in Scanning Tunneling Spectroscopy of single Atoms and Molecules on Metal Surfaces. Wahl, P, Diekhöner, L, Schneider MA, Kern, K, I: Review of Scientific Instruments. 2008, vol. 79, Issue 4, pp. 043104-043104-4

Band structure and effective mass of InN under pressure. Gorczyca, I, Dmowski, L, Plesiewicz, J, Suski, T, Christensen, NE, Svane, A, Gallinat, CS, Koblmueller, G, Speck, JS, I: Physica Status Solidi. B: Basic Research. 2008; vol. 245, no. 5, pp. 887-889

Band structure effects on the Be(0001) acoustic surface plasmon energy dispersion. Silkin, VM, Pitarke, JM, Chulkov, EV, Diaconescu, B, Pohl, K, Vattuone, L, Savio, L, Hofmann, P, Farías, D, Rocca, M, Echenique, PM, I: Physica Status Solidi - A - Applications and Materials Science. 2008; pp. 1307-1311

Bestrophin-3 (vitelliform macular dystrophy 2-like 3 protein) is essential for the cGMP-dependent calcium-activated chloride conductance in vascular smooth muscle cells. Matchkov, V, Larsen, P, Bouzinova, EV, Rojek, A, Golubinskaya, V, Bødtkjer, DMB, Pedersen, FS, Aalkjær, C, Nilsson, H, I: Circulation Research. 2008; vol. 103, no. 8, pp. 864-872

Bilayer growth of nanoscale Co islands on Cu(111). Negulyaev, NN, Stepanyuk, VS, Bruno, P, Diekhöner, L, Wahl, P, Kern, K, I: Physical Review B. 2008, vol. 77, pp.125437

Binding of Serotonin to the Human Serotonin Transporter. Molecular Modeling and Experimental Validation. Celik, L, Sinning, S, Severinsen, K, Hansen, CG, Møller, MS, Bols, M, Wiborg, O, Schiøtt, B, I: Journal of the American Chemical Society. 2008; pp. 3853-3865

Biocatalysis of theophylline oxidation by microbial theophylline oxidase in the presence of non-physiological electron acceptors. Ferapontova, E, Shipovskov, S, I: Biocatalysis and Biotransformation. 2008; vol. 26, no. 6, pp. 508-518

Bovine Serum Albumin Adsorption on Nano-rough Platinum Surfaces studied by QCM-D. Dolatshahi-Pirouz, A, Rechendorff, K, Hovgaard, MB, Foss, M, Chevallier, J, Besenbacher, F, I: Colloids and Surfaces B: Biointerfaces. 2008; vol. 66, pp. 53

Bowing of the band gap pressure coefficient in $In_xGa_{1-x}N$ alloys. Franssen, G, Gorczyca, I, Suski, T, KamiÐska, A, Pereiro, J, Muñoz, E, Iliopoulos, E, Georgakilas, A, Che, SB, Ishitani, Y, Yoshikawa, A, Yoshikawa, A, Christensen, NE, Svane, A, I: Journal of Applied Physics. 2008; vol. 103, Issue 3, pp. 033514-033514-6

Bridging One Helical Turn in dsDNA by Templated Dimerization of Molecular Rods. Andersen, CS, Yan, H, Gothelf, KV, I: Angewandte Chemie - International Edition. 2008; vol. 47, pp. 5569-5572

Calculus removal on a root cement surface by ultrashort laser pulses. Kraft, JF, Vestentoft, K, Christensen, BH, Lovschall, H, Balling, P, I: Applied Surface Science. 2008; vol. 254, no. 7, pp. 1895-1899

Carotid Plaque Stresses. Samuel, SA, Nygaard, JV, I: Recent Advances in Modelling and Simulation. Edited by Giuseppe Petrone and Giuliano Cammarata: I-Tech Education and Publishing KG. , Vienna, Austria, 2008, pp.167-184

Catalytic activity of laccases in aqueous solutions of ionic liquids. Shipovskov, S, Gunaratne, HQN, Seddon, KR, Stephens, G, I: Green Chemistry. 2008; vol. 10, no. 7, pp. 806-810

Catalytic Properties of ADAM12 and Its Domain Deletion Mutants. Jacobsen, J, Visse, R, Sørensen, HP, Enghild, JJ, Brew, K, Wewer, UM, Nagase, H, I: Biochemistry. 2008;47 (2), pp. 537–547

Characterisation of a site on pai-1 that binds to vitronectin outside of the somatomedin B domain. Andreasen, P, Jensen, JK, Christensen, A, Blouse, G, Schar, CR, Peterson, CB, I: Journal of Biological Chemistry. 2008; vol. 283, no. 42, pp. 28487-28496

Characterization of cement minerals, cements and their reaction products at the atomic and nano scale. Skibsted, J, Hall, C, I: Cement and Concrete Research. 2008; vol. 38, pp. 205-225

Characterization of Dry Globular Proteins and Protein Fibrils by Synchrotron Radiation Vacuum UV Circular Dichroism. Nesgaard, LW, Hoffmann, SV, Andersen, CB, Malmendal, A, Otzen, D, I: Biopolymers. 2008; vol. 89, no. 9, pp. 779-795

Characterization of human mucin (MUC15) and identification of ovine and caprine orthologs. Pallesen, LT, Pedersen, LRL, Petersen, TE, Knudsen, CR, Rasmussen, JT, I: Journal of Dairy Science. 2008; vol. 91, no. 12, pp. 4477-83

Characterization of osteopontin expression and function after status epilepticus. Borges, K, Gearing, M, Rittling, S, Sørensen, ES, Kotloski, R, Denhardt, DT, Dingledine, R, I: Epilepsia. 2008; vol. 49, pp. 1675-1685

Chemical bath deposition of PbS nanocrystals: Effect of substrate. Gaiduk, AP, Gaiduk, PI, Nylandsted Larsen, A, I: Thin Solid Films. 2008; vol. 516, pp. 3791-3795

Chromium oxide-based multilayer coatings deposited by reactive magnetron sputtering in an industrial setup. Eklund, P, Mikkelsen, NJ, Sillassen, MB, Bienk, EJ, Bøttiger, J, I: Surface and Coatings Technology. 2008; no. 203, pp. 156-159

Classical Reagents: New Surprises in Palladium-Catalyzed C-C Coupling Reactions. Lindhardt, AT, Skrydstrup, T, I: Chemistry: A European Journal. 2008; vol. 14, pp. 8756

Clean HMBC: Suppression of strong-coupling induced artifacts in HMBC spectra. Würtz, P, Permi, P, Nielsen, NC, Sørensen, OW, I: Journal of Magnetic Resonance. 2008; vol. 194, no. 1, pp. 89-98

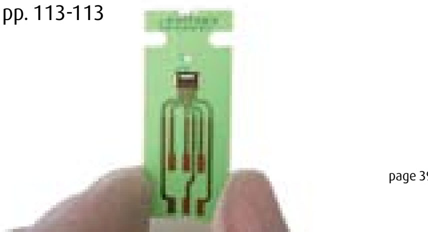
Comparative genomics beyond sequence based alignments: RNA structures in the ENCODE regions. Torarinsson, E, Yao, Z, Wiklund, ED, Bramsen, JB, Hansen, C, Kjems, J, Tommerup, N, Ruzzo, WL, Gorodkin, J, I: Genome Research. 2008; vol. 18, pp. 242-251

Conduction band filling in In-rich InGaN and InN under hydrostatic pressure. Franssen, G, Kamińska, A, Suski, T, Gorczyca, I, Christensen, NE, Svane, A, Lu, H, Schaff, WJ, Dimakis, E, Georgakilas, A, Che, SB, Ishitani, Y, Yoshikawa, A, I: Physica Status Solidi. C, Current topics in solid state physics. 2008; vol. 5, no. 6, pp. 1488-1490

Connectivity and Entanglement Stress Contributions in Strained Polymer Networks. Svaneborg, C, Everaers, R, Grest, GS, Curro, JG, I: Macromolecules. 2008; vol. 41, no. 13, pp. 4920-4928

Consecutive photodissociation of a single complex molecular ion. Højbjerre, K, Offenberg, D, Bisgaard, C, Stapelfeldt, H, Staanum, P, Mortensen, A, Drewsen, M, I: Physical Review A. Atomic, Molecular, and Optical Physics. 2008; vol. 77, Issue 3, pp. 030702

Correlation between epstein-barr virus (EBV) RNA expression and vascular endothelial growth factor (VEGF) expression in different subtypes of peripheral T-cell lymphomas (PTCL) and prognostic implications. Jørgensen, JM, Sørensen, FB, Bendix, K, Nielsen, JL, Funder, AMD, Karkkainen, MJ, Tainola, T, Pedersen, FS, Sørensen, AB, Kühle, AVDA, d'Amore, FA, I: Annals of oncology. 2008; pp. 113-113



Publications

Covalent Sidewall Functionalization of Carbon Nanotubes by a "Formation-Degradation" Approach. Peng, Z, Holm, AH, Nielsen, LT, Pedersen, SU, Daasbjerg, K, I: Chemistry of Materials. 2008; vol. 20, pp. 6068-6075

Critical Size of Crystalline ZrO_2 Nanoparticles Synthesized in Near- and Supercritical Water and Supercritical Isopropyl Alcohol. Becker-Christensen, J, Hald, P, Bremholm, M, Pedersen, JS, Chevallier, J, Iversen, SB, Iversen, BB, I: ACS Nano. 2008; vol. 2, no. 5, pp. 1058-1068

Crystal Structure of D351A and P312A Mutant Forms of the Mammalian Sarcoplasmic Reticulum Ca^{2+}-ATPase Reveals Key Events in Phosphorylation and Ca^{2+} Release. Marchand, A, Winther, AML, Holm, P, Olesen, C, Montigny, C, Arnou, B, Champeil, P, Clausen, JD, Vilsen, B, Andersen, JP, Nissen, P, Jaxel, C, Møller, JV, le Maire, M, I: Journal of Biological Chemistry. 2008; vol. 283, no. 21, pp. 14867-14882

Delivery of siRNA from lyophilised polymeric surfaces. Andersen, MØ, Howard, KA, Paludan, SR, Besenbacher, F, ; Kjems, J, I: Biomaterials. 2008; vol. 29, pp. 506-512

Dendrimers destabilize proteins in a generation-dependent manner involving electrostatic interactions. Giehm, L, Christensen, C, Boas, U, Heegaard, PMH, Otzen, D, I: Biopolymers. 2008; vol. 89, pp. 522-529

Denitrification, nitrate turnover, and aerobic respiration by benthic foraminiferans in the oxygen minimum zone off Chile. Høgslund, S, Revsbech, NP, Cedhagen, T, Nielsen, LP, Gallardo, VA, I: Journal of Experimental Marine Biology and Ecology. 2008; vol. 359, pp. 85-91

Deposition at glancing angle, surface roughness, and protein adsorption: Monte Carlo simulations. Zhdanov, V, Rechendorff, K, Hovgaard, MB, Besenbacher, F, I: Journal of Physical Chemistry B. 2008; vol. 112, pp. 7267-7272

Detailed scanning probe microscopy tip models determined from simultaneous atom-resolved AFM and STM studies of the TiO_2(110) surface. Enevoldsen, GH, Pinto, HP, Foster, AS, Jensen, MCR, Kühnle, A, Reichling, M, Hofer, WA, Lauritsen, JV, Besenbacher, F, I: Physical Review B. Condensed Matter and Materials Physics. 2008; vol. 78, pp. 045416

DFT Study of Solvation Effects on the Tautomeric Equlibrium and Catalytic Ylide Generation of Thiamin Models. Schiøtt, B, Lie, MA, I: Journal of Computational Chemistry. 2008; vol. 29, pp. 1037-1047

Differential adsorption of variants of the thermomyces lanuginosus lipase on a hydrophobic surface suggests a role for local flexibility. Otzen, D, I: Colloids and Surfaces B: Biointerfaces. 2008; no. 64, pp. 223-228

Diffusion and defect reactions between donors, C, and vacancies in Ge. I. Experimental results. Brotzmann, S, Bracht, H, Hansen, JL, Nylandsted Larsen, A, Simoen, E, Haller, EE, Christensen, JS, Werner, P, I: Physical Review B. Condensed Matter and Materials Physics. 2008; vol. 77, pp. 235207

Direct Entry to Peptidyl Ketones via SmI_2-Mediated C−C Bond Formation with Readily Accessible N-Peptidyl Oxazolidinones. Mittag, T, Christensen, KL, Lindsay, K, Nielsen, NC, Skrydstrup, T, I: Journal of Organic Chemistry. 2008; vol. 73, no. 3, pp. 1088–1092

Direct Vinylation and Difluorovinylation of Arylboronic Acids Using Vinyl- and 2,2-Difluorovinyl Tosylates via the Suzuki-Miyaura Cross Coupling. Gøgsig, TM, Søbjerg, LS, Lindhardt, AT, Jensen, KL, Skrydstrup, T, I: Journal of Organic Chemistry. 2008; vol. 73, pp. 3404

DNA Origami Design of Dolphin-Shaped Structures with Flexible Tails. Andersen, ES, Dong, M, Nielsen, MM, Jahn, K, Lind-Thomsen, A, Mamdouh, W, Gothelf, KV, Besenbacher, F, Kjems, J, I: ACS Nano. 2008; vol. 2, pp. 1213-1218

Doppler cooling of calcium ions using a dipole-forbidden transition. Hendricks, R, Sørensen, JL, Champenois, C, Knoop, M, Drewsen, M, I: Physical Review A. Atomic, Molecular, and Optical Physics. 2008; vol. 77, pp. 021401

Early Stages of Amyloid Fibril Formation Studied by Liquid-State NMR: The Peptide Hormone Glucagon. Svane, ASP, Jahn, K, Deva, T, Malmendal, A, Otzen, D, Dittmer, J, Nielsen, NC, I: Biophysical Journal. 2008; vol. 95, no. 1, pp. 366 – 377

Effect of glycosylation on biphysical and flocculative properties of the extracellular domain of Ag43. Knudsen, SK, Westergaard, UB, Frantzmann, M, Stensballe, A, Otzen, D, I: Biochemical Journal. 2008; no. 412, pp. 563-577

Effect of Solvent on Two-Photon Absorption by Vinyl Benzene Derivatives. Johnsen, M, Ogilby, PR, I: Journal of Physical Chemistry A. 2008; vol. 112, pp. 7831-7839

Effects of Conjugation Length and Resonance Enhancement on Two-Photon Absorption in Phenylene-Vinylene Oligomers. Johnsen, M, Paterson, MJ, Arnbjerg, J, Christiansen, O, Nielsen, CB, Jørgensen, M, Ogilby, PR, I: Physical

Chemistry Chemical Physics. 2008; vol. 10, pp. 1177-1191

Effects of the order-disorder phase transition on the physical properties of A8Sn44[]2 (A = Rb, Cs). Kaltzoglou, A, Fässler, T, Christensen, M, Johnsen, S, Iversen, BB, Presniakov, I, Sobolev, A, Shevelkov, A, I: Journal of Materials Chemistry. 2008; vol. 18, pp. 5630-5637

Electrochemical control of a DNA Holliday Junction nanoswitch by Mg2+ ions. Ferapontova, EE, Mountford, CP, Crain, J, Buck, AH, Dickinson, P, Beattie, JS, Ghazal, P, Terry, JG, Walton, AJ, Mount, AR, I: Biosensors and Bioelectronics. 2008; vol. 24, no. 3, pp. 422-428

Electrochemical Surface Derivatization of Glassy Carbon by the Reduction of Triaryl- and Alkyldiphenylsulfonium Salts. Vase, KH, Holm, AH, Norrman, K, Pedersen, SU, Daasbjerg, K, I: Langmuir. 2008; vol. 24, pp. 182-188

Electronic structure and effective masses of InN under pressure. Gorczyca, I, Plesiewicz, J, Dmowski, L, Suski, T, Christensen, NE, Svane, A, Gallinat, CS, Koblmueller, G, Speck, JS, I: Journal of Applied Physics. 2008; vol. 104, pp. 013704

Electronic Structure of GaAs1-xNx Under Pressure. Gorczyca, I, Boguslawski, P, Svane, A, Christensen, NE, I: Dilute III-V Nitride Semiconductors and Material Systems : Springer Series in Materials Science. red. Ayse Erol. Bd. 105 Springer Verlag, Springer Series in Materials Science. 2008. pp. 92-122

Electrospinning of Cyclodextrin-Pseudopolyrotaxane Nanofibers. Uyar, T, Kingshott, P, Besenbacher, F, I: Angewandte Chemie - International Edition. 2008; vol. 47, pp. 9108-9111

Electrospinning of uniform polystyrene fibers: The effect of solvent conductivity. Uyar, T, Besenbacher, F, I: Polymer. 2008; vol. 49, pp. 5336-5343

Elementary structural motifs in a random network of cytosine adsorbed on a gold (111) surface. Otero Martin, R, Lukas, M, Kelly, REA, Xu, W, Lægsgaard, E, Stensgaard, I, Kantorovich, LN, Besenbacher, F, I: Science. 2008; vol. 319, pp. 312-315

Enhanced nanoplasmonic optical sensor with reduced substrate effect. Dmitriev, A, Hägglund, C, Chen, S, Frederiksson, H, Pakizeh, T, Käll, M, Sutherland, D, I: Nano Letters. 2008; vol. 8, no. 11, pp. 3893-3898

Enzymatic activity of the Staphylococcus aureus SplB serine protease is induced by substrates containing the sequence Trp-Glu-Leu-Gln. Dubin, G, Stec-Niemczyk, J, Kisielewska, M, Pustelny, K, Popowicz, GM, Bista, M, Kantyka, T, Boulware, KT, Stennicke, HR, Czarna, A, Phopaisarn, M, Daugherty, PS, Thøgersen, I, Enghild, JJ, Thornberry, N, Dubin, A, Potempa, J, I: Journal of Molecular Biology. 2008; vol. 379, issue 2, pp.343-356

Enzymatic interesterification of palm stearin and coconut oil by a dual lipase system. Ibrahim, NA, Guo, Z, Xu, X, I: Journal of the American Oil Chemists' Society. 2008; vol. 85, pp. 37-45

Enzymatic modification of phospholipids. Xu, X, Vikbjerg, AF, Guo, Z, Zhang, L, Acharya, AK, I: Phospholipid Science and Technology. 2008; pp. 41-82

Enzymatic synthesis of designer lipids. Devi, BLAP, Zhang, H, Damstrup, ML, Guo, Z, Zhang, L, Lue, BM, Xu, X, I: OCL - Oleagineux - Corps Gras - Lipides. 2008; vol. 15, no. 3, pp. 189-195

ESC resistance of commercial grade polycarbonates during exposure to butter and related chemicals. Kjellander, CK, Nielsen, TB, Ghanbari-Siahkali, A, Kingshott, P, Hansen, CM, Almdal, K, I: Polymer Degradation and Stability. 2008; pp. 1486-1495

Ethical Perspectives on RNA interference Therapeutics. Ebbesen, M, Jensen, TG, Andersen, S, Pedersen, FS, I: International Journal of Medical Sciences. 2008; no. 3, pp. 159-168

Evaluation of oxygen injection as a means of controlling sulfide production in a sewer system. Gutierrez, O, Mohanakrishnan, J, Sharma, KR, Meyer, RL, Keller, J, Juan, Z, I: Water Research. 2008; vol. 42, no. 17, pp. 4549-4561

Expansion of the F127-templated mesostructure in aerosol-generated particles by using polypropylene glycol as a swelling agent. Sörensen, MH, Corkery, RW, Pedersen, JS, Rosenholm, J, Alberius, PC, I: Microporous and Mesoporous Materials. 2008; vol. 113, pp. 1-13

Experimental and Theoretical Charge Density Study of Chemical Bonding in a Co Dimer Complex. Overgaard, J, Clausen, HF, Platts, JA, Iversen, BB, I: Journal of the American Chemical Society. 2008; vol. 130, pp. 3834-3843

Exploring Interactions of Endocrine Disrupting Compounds with Different Conformations of the Human Estrogen Receptor α. A Molecular Docking Study. Schiøtt, HB, Celik, L, Lund, JDD, I: Chemical Research in Toxicology. 2008; vol. 21, pp. 2195-2206

Extended one-dimensional supramolecular assembly on a stepped surface. Schnadt, J, Rauls, E, Xu, W, Vang, RT, Knudsen, J, Lægsgaard, E, Li, Z, Hammer, B, Besenbacher, F, I: Physical Review Letters. 2008; vol. 100, pp. 046103

Extracellular matrix remodelling during cell adhesion monitored by the quartz crystal microbalance. Lord, M, Modin, C, Foss, M, Duch, MR, Simmons, A, Pedersen, FS, Besenbacher, F, Milthorpe, BK, I: Biomaterials. 2008; vol. 29, pp. 2581-2587

Extracellular superoxide dismutase protects against matrix degradation of heparan sulfate in the lung. Kliment, CR, Tobolewski, JM, Manni, ML, Tan, RJ, Enghild, JJ, Oury, TD, I: Antioxidants & Redox Signaling. 2008 ; vol. 10(2):pp. 261-8

Fast in vitro translation system immobilized on a surface via specific biotinylation of the ribosome. Stapulionis, R, Wang, Y, Dempsey, GT, Khudaravalli, R, Nielsen, KM, Cooperman, BS, Goldman, YE, Knudsen, CR, I: Biological Chemistry. 2008; vol. 389, no. 9, pp. 1239-1249

Fibronectin adsorption on gold, Ti and Ta-oxide investigated by QCM-D and RSA modelling. Hemmersam, AG, Rechendorf, K, Foss, M, Sutherland, D, Besenbacher, F, I: Journal of Colloid and Interface Science. 2008; vol. 320, pp. 110-116

Fibronectin Adsorption on Tantalum: The Influence of Nanoroughness. Hovgaard, MB, Rechendorff, K, Chevallier, J, Foss, M, Besenbacher, F, I: Journal of Physical Chemistry B. 2008; vol. 112, pp. 8241-8249

Flow perfusion culture of human mesenchymal stem cells on silicate-substituted tricalcium phosphate scaffolds. Jensen, LB, Bünger, C, Kassem, M, Mygind, T, I: Biomaterials. 2008; vol. 29, pp. 2616-2627

Focus on molecules: Transforming growth factor beta induced protein (TGFBIp). Runager, K, Enghild, JJ, Klintworth, G, I: Experimental Eye Research. 2008 ; vol. 87, issue 4, pp.298-299

Formation and Transformation of Five Different Phases in the CaSO4-H2O System: Crystal Structure of the Subhydrate β-CaSO4.0.5H2O and Soluble Anhydrite CaSO4. Christensen, AN, Olesen, M, Cerenius, Y, Jensen, TR, I: Chemistry of Materials. 2008; vol. 20, pp. 2124-2132

Formation of Ca(BH4)2 from Hydrogenation of CaH2 + MgB2 Composite. Barkhordarian, G, Jensen, TR, Doppiu, S, Bösenberg, U, Borgschulte,

Publications

A, Gremaud, R, Cerenius, Y, Dornheim, M, Klassen, T, Bormann, R, I: Journal of Physical Chemistry C. 2008; vol. 112, pp. 2743-2749

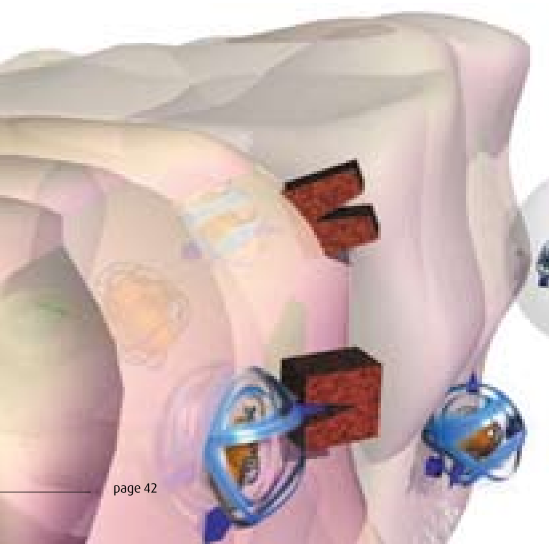
Formation of Trioctylamine from Octylamine On Au(111). Weigelt, S, Schnadt, J, Tuxen, AK, Masini, F, Bombis, C, Busse, CW, Isvoranu, C, Ataman, E, Lægsgaard, E, Besenbacher, F, Linderoth, TR, I: Journal of the American Chemical Society. 2008; vol. 130, pp. 5388

Freeze tolerance and accumulation of cryoprotectants in the enchytraeid Enchytraeus albidus (Oligochaeta) from Greenland and Europe. Slotsbo, S, Maraldo, K, Malmendal, A, Nielsen, NC, Holmstrup, M, I: Cryobiology. 2008; vol. 57, pp. 286-291

Function Follows Form: Exploring Two-Dimensional Supramolecular Assembly at Surfaces. Tait, SL, I: ACS Nano. 2008; vol. 2, no. 4, pp. 617-621

Gallium interstitial in irradiated germanium: Deep level transient spectroscopy. Kolkovsky, V, Petersen, MC, Mesli, A, Van Gheluwe, J, Clauws, P, Nylandsted Larsen, A, I: Physical Review B. Condensed Matter and Materials Physics. 2008; vol. 78, no. 23, pp. 233201

Gene conversion and purifying selection of a placenta-specific ERV-V envelope gene during simian evolution. Kjeldbjerg, A, Villesen, P, Aagaard, L, Pedersen, FS, I: BMC Evolutionary Biology. 2008; vol. 8, no. 1, pp. 266



Graphene antidot lattices - designed defects and spin qubits. Garm Pedersen, T, Flindt, C, Pedersen, J, Jauho, AP, Mortensen, NA, Pedersen, K, I: Physical Review Letters, 2008; vol. 100, pp. 136804

Hartree-Fock and Kohn-Sham time-dependent response theory in a second-quantization atomic-orbital formalism suitable for linear scaling. Kjærgaard, T, Jørgensen, P, Olsen, J, Coriani, S, Helgaker, T, I: Journal of Chemical Physics. 2008; vol. 129, no. 5, pp. 054106

Heavy Metals in the Jaws of Invertebrates. Lichtenegger, HC, Birkedal, H, Waite, JH, I: Metal Ions in Life Sciences. 2008; vol. 4, pp. 295-325

Helium cryostat synchrotron charge densities determined using a large CCD detector - the upgraded beamline D3 at DESY. Morgenroth, W, Overgaard, J, Clausen, HF, Svendsen, H, Jørgensen, MR, Larsen, FK, Iversen, BB, I: Journal of Applied Crystallography. 2008; vol. 41, pp. 846-853

Helix conformations in 7TM membrane proteins determined using oriented-sample solid-state NMR with multiple residue-specific 15N labeling. Vosegaard, T, Kamihira-Ishijima, M, Watts, A, Nielsen, NC, I: Biophysical Journal. 2008; vol. 94, pp. 241-250

High performance liquid chromatography analysis methods developed for quantifying enzymatic esterification of flavonoids in ionic liquids. Lue, BM, Guo, Z, Xu, X, I: Journal of Chromatography A. 2008; vol. 1198–1199, pp. 107–114

High temperature thermoelectric efficiency on Ba8Ga16Ge30. Toberer, ES, Christensen, M, Iversen, BB, Snyder, GJ, I: Physical Review B. Condensed Matter and Materials Physics. 2008; vol. 77, pp. 075203

Homogeneous Esterification by Lipase From Burkholderia cepacia in the Fluorinated Solvent. Shipovskov, S, I: Biotechnology Progress. 2008; vol. 24, no. 6, pp. 1262-1266

Host-guest coupling in semiconducting Ba8Zn8Ge38. Christensen, M, Iversen, BB, I: Journal of Physics: Condensed Matter. 2008; vol. 20, pp. 1-6

Human skin keratins are the major proteins in exhaled breath condensate. Hoffmann, HJ, Enghild, JJ, Dahl, R, Tabaksblat, L, I: European Respiratory Journal. 2008; vol. 31, pp. 1-5

Hydrolysis and stability of thin pulsed plasma polymerized maleic anhydride coatings. Drews, J, Launay, H, Hansen, CM, West, K, Hvilsted, S, Kingshott, P, I: Applied Surface Science. 2008; vol. 254, no. 15, pp. 4720-4725

Hydrothermal synthesis of nanocrystalline ZnSe: An in situ synchrotron radiation X-ray powder diffraction study. Jørgensen, JE, Jensen, TR, Hanson, JC, I: Journal of Solid State Chemistry. 2008; vol. 181, pp. 1925-1929

Identification and function of a cytoplasmic K+ site of the Na+,K+ATPase. Schack, VR, Morth, JP, Toustrup-Jensen, MS, Anthonisen, AN, Nissen, P, Andersen, JP, Vilsen, B, I: Journal of Biological Chemistry. 2008; vol. 283, no. 41, pp. 27982-27990

Independent trapping, manipulation and characterization by an all-optical biophotonics workstation. Ulriksen, HU, Thøgersen, J, Keiding, SR, Perch Nielsen, IR, Dam, JS, Palima, DZ, Stapelfeldt, H, Gluckstad, J, I: European Optical Society Journal. Rapid Publications. 2008; vol. 3, pp. 08034

Influence of alkyl side chains on hydrogen-bonded molecular surface nanostructures. Xu, W, Dong, M, Gersen, H, Rauls, E, Vázquez-Campos, S, Crego-Calama, M, Reinhoudt, DN, Lægsgaard, E, Stensgaard, I, Linderoth, TR, Besenbacher, F, I: Small. 2008; vol. 4, pp. 1620-1623

Influence of beta-Cyclodextrin on the Mixed Micellization Process of Sodium Dodecyl Sulfate and Sodium Lauroyl Sarcosine and Formation of Inclusion Complexes. Sehgal, P, Sharma, D, Larsen, KL, Wimmer, R, Otzen, D, Doe, H, I: Journal of Dispersion Science and Technology. 2008; vol. 29, pp. 128-133

Influence of nanotopography on phospholipid bilayer formation on silicon dioxide. Pfeiffer, I, Seantier, S, Petronis, S, Sutherland, D, Kasemo, B, Zäch, M, I: Journal of Physical Chemistry B. 2008; vol. 112, no. 16, pp. 5175-5181

InSb Nanocrystals Embedded in SiO2: Strain and Melting-Point Hysteresis. Tetu, A, Chevallier, J, Nielsen, BB, I: Materials Science & Engineering: B. Solid-state Materials for Advanced Technology. 2008; vol. 147, issues 2-3, pp. 141-143

"Inside" vs "Outside" Photooxygenation Reactions: Singlet-Oxygen-Mediated Surface Passivation of Polymer Films. Silva Goncalves, E, Ogilby, PR, I: Langmuir. 2008; vol. 24, pp. 9056-9065

Interactions of g-Cyclodextrin with the Mixed Micelles of Anionic Surfactants and Their Inclusion Complexes Formation. Sehgal, P, Sharma, M, Larsen, KL, Wimmer, R, Doe, H, Otzen, D, I: Journal of Dispersion Science and Technology. 2008; vol. 29, pp. 885-890

Intermolecular Enyne Isomerization: Development of an Atom Efficient Mizoroki-Heck Type Coupling. Lindhardt, AT, Mantel, MLH, Skrydstrup, T, I: Angewandte Chemie - International Edition. 2008; vol. 47, pp. 2668

Intracellular siRNA and precursor miRNA trafficking using bioresponsive copolypeptides. Rahbek, UL, Howard, KA, Oupicky, D, Manickam, DS, Dong, M, Nielsen, AF, Hansen, TB, Besenbacher, F, Kjems, J, I: Journal of Gene Medicine. 2008; vol. 10, pp. 81-93

Investigating the biomarker potential of glycoproteins using comparative glycoprofiling - application to tissue inhibitor of metalloproteinases-1. Thaysen-Andersen, M, Thøgersen, I, Lademann, U, Offenberg, H, Enghild, JJ, Nielsen, HJ, Giessing, AM, Brünner, N, Højrup, P, I: Biochimica et Biophysica Acta. 2008; Volume 1784, Issue 3, pp. 455-463

Investigation of particle-functionalised tissue engineering scaffolds using X-ray tomographic microscopy. Nygaard, JV, Andersen, MØ, Howard, K, Foss, M, Bünger, C, Kjems, J, Besenbacher, F, I: Biotechnology and Bioengineering. 2008; vol. 100, pp. 820-829

Irradiation-induced defects in SiGe. Nylandsted Larsen, A, Bro Hansen, A, Mesli, A, I: Materials Science & Engineering: B. Solid-state Materials for Advanced Technology. 2008; vol. 154-155, pp. 85-89

Irregularities in the Effect of Potassium Phosphate in Ynamide Synthesis. Dooleweerdt, K, Birkedal, H, Ruhland, T, Skrydstrup, T, I: Journal of Organic Chemistry. 2008; vol. 73, no. 23, pp. 9447-9450

Kinetic study of sphingomyelin hydrolysis for ceramide production. Zhang, L, Hellgren, L, Xu, X, I: Journal of Molecular Catalysis B: Enzymatic. 2008; vol. 51, pp. 93-99

Labeling of DNA via rearrangement of S-2-aminoethyl phosphorothioates to N-(2-mercaptoe thyl)phosphoramidates. Chen, M, Gothelf, KV, I: Organic & Biomolecular Chemistry. 2008; vol. 6, pp. 908-911

Large scale isolation and purification of soluble RAGE from lung tissue. Englert, JM, Ramsgaard, L, Valnickova, Z, Enghild, JJ, Oury, TD, I: Protein Expression and Purification. 2008; vol. 61, no. 1, pp. 99-101

Linear optical and quadratic electro-optic response of carbon nanotubes: Universal analytic expressions for arbitrary chirality. Zarifi, A, Garm Pedersen, T, I: Journal of Physics. Condensed Matter. 2008; vol. 20 pp.275211

Loading of large ion Coulomb crystals into a linear Paul trap incorporating an optical cavity. Herskind, PF, Dantan, A, Langkilde-Lauesen, MB, Mortensen, A, Sørensen, JL, Drewsen, M, I: Applied Physics. B, Lasers and Optics. 2008; vol. 93, no. 2-3, pp. 373-379

Low-temperature irradiation-induced defects in germanium: In situ analysis. Mesli, A, Dobaczewski, L, Nielsen, KB, Kolkovsky, V, Petersen, MC, Nylandsted Larsen, A, I: Physical Review B. Condensed Matter and Materials Physics. 2008; vol. 78, pp. 165-202

Male zebrafish (*Danio rerio*) courtship behaviour resists the feminising effects of 17α-ethinyloestradiol - morphological sexual characteristics do not. Larsen, MGG, Hansen, KB, Henriksen, PG, Baatrup, E, I: Aquatic Toxicology. 2008; vol. 87, pp. 234-244

Mechanical stresses in carotid plaques using MRI-based fluid-structure interaction models. Kock, SA, Nygaard, JV, Eldrup, N, Fründ, ET, Klærke, A, Paaske, WP, Falk, E, Yong Kim, W, I: Journal of Biomechanics. 2008; vol. 41, no. 8, pp. 1651-1658

Metabolomic Signatures of Inbreeding at Benign and Stressful Temperatures in *Drosophila melanogaster*. Pedersen, KS, Kristensen, TN, Loeschcke, V, Pedersen, BO, Duus, JØ, Nielsen, NC, Malmendal, A, I: Genetics. 2008; vol. 180, pp. 1233-1243

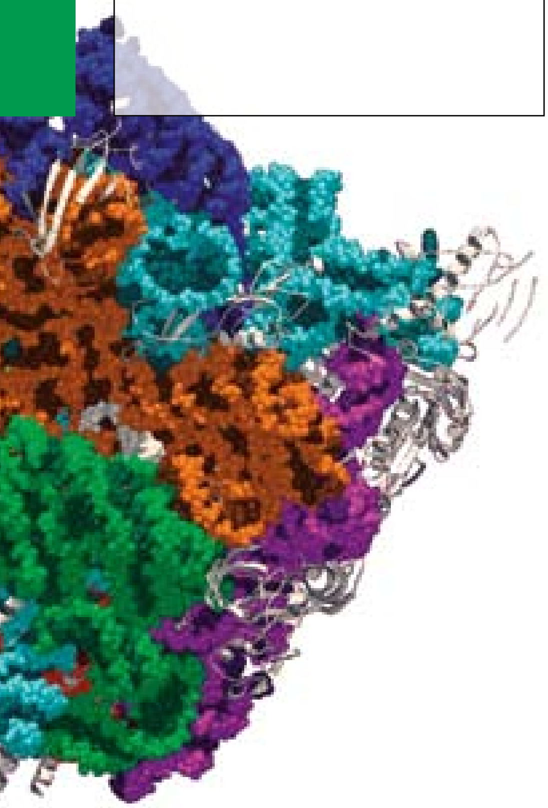
Metal-Enhanced 1270 nm Singlet Oxygen Phosphorescence. Toftegaard, R, Arnbjerg, J, Daasbjerg, K, Ogilby, PR, Dmitriev, A, Sutherland, D, Poulsen, L, I: Angewandte Chemie - International Edition. 2008; vol. 47, pp. 6025-6027

Metamagnetic behavior in Fe3Si and Fe3Al. Christensen, NE, Kudrnovský, J, Rodriguez, CO, I: International Journal of Nanoelectronics and Materials. 2008; vol. 1, pp. 1-15

Microscopic dynamics of a base protonation. Knudsgaard, B, Petersen, C, Thøgersen, J, Keiding, SR, Jensen, SK, I: Chemical Physics Letters. 2008; vol. 463, pp. 357-359

Microstructure engineering of Portland cement pastes and mortars through addition of ultrafine

Publications



layer silicates. Lindgreen, H, Geiker, M, Krøyer, H, Springer, N, Skibsted, J, I: Cement and Concrete Composites. 2008; vol. 30, pp. 686-699

Molecular recognition with DNA nanoswitches: Effects of single base mutations on structure. Mountford, CP, Buck, AH, Campbell, CJ, Dickinson, P, Ferapontova, EE, Terry, JG, Beattie, JS, Walton, AJ, Ghazal, P, Mount, AR, Crain, J, I: Journal of Physical Chemistry B. 2008; vol. 112, no. 8, pp. 2439-2444

Molecular Self-Assembly from Building Blocks Synthesized on a Surface in Ultrahigh Vacuum: Kinetic Control and Topo-Chemical Reactions. Weigelt, S, Bombis, C, Busse, CW, Knudsen, MM, Gothelf, KV, Lægsgaard, E, Besenbacher, F, Linderoth, TR, I: ACS Nano. 2008; vol. 2, pp. 651-660

Morphology, Dispersion, and Stability of Cu Nanoclusters on Clean and Hydroxylated alpha-Al2O3(0001) Substrates. Jensen, MCR, Venkataramani, K, Helveg, S, Clausen, BS, Reichling, M, Besenbacher, F, Lauritsen, JV, I: Journal of Physical Chemistry C. 2008; vol. 112, pp. 16953–16960

Morphology, proliferation, and osteogenic differentiation of mesenchymal stem cells cultured on titanium, tantalum, and chromium surfaces. Stiehler, M, Lind, M, Mygind, T, Baatrup, A, Dolatshahi-Pirouz, A, Li, H, Foss, M, Besenbacher, F, Kassem, M, Bünger, C, I: Journal of Biomedical Materials Research. Part A. 2008; vol. 86, no. 2, pp. 448-458

Multiphoton electron angular distributions from laser-aligned CS2 molecules. Kumarappan, V, Holmegaard, L, Martiny, C, Madsen, CB, Kjeldsen, TK, Viftrup, S, Madsen, LB, Stapelfeldt, H, I: Physical Review Letters. 2008; vol. 100, pp. 093006

Mutation of C/EBP{ alpha} predisposes to the development of myeloid leukemia in a retroviral insertional mutagenesis screen. Hasemann, MS, Damgaard, I, Schuster, MB, Theilgaard-Monch, K, Sørensen, AB, Mrsic, A, Krugers, T, Ylstra, B, Pedersen, FS, Nerlov, C, Porse, BT, I: Blood. 2008 ; vol.111(8), pp.4309-4321

Nano-structured cell-adhesive and cell-repulsive plasma deposited coatings: Chemical and topographical effects on keratinocyte adhesion. Sardella, E, Detomaso, L, Gristina, R, Senesi, GS, Agheli, H, Sutherland, D, d'Agostino, R, Favia, P, I: Plasma Processes and Polymers. 2008; vol. 5, pp. 6, pp. 540-551

Negative-U property of interstitial hydrogen in GaAs. Kolkovsky, V, Nielsen, KB, Nylandsted Larsen, A, Dobaczewski, L, I: Physical Review B. Condensed Matter and Materials Physics. 2008; vol. 78, pp. 035211

Niels Ole Kjeldgaard, 2. juni 1926 - 31. maj 2006. Pedersen, FS. I: Det Kongelige Danske Videnskabernes Selskab, Oversigt over Selskabets Virksomhed 2006-2007. København : Det Kongelige Danske Videnskabernes Selskab, 2008. pp. 229-234

Nitrification and denitrification as sources of sediment nitrous oxide production: A microsensor study. Meyer, RL, Allen, DE, Smith, S, I: Marine Chemistry. 2008; vol. 110, issues 1-2, pp. 68-76

Nitrite effectively inhibits sulfide and methane production in a laboratory scale sewer reactor. Mohanakrishnan, J, Gutierrez, O, Meyer, RL, Yuan, Z, I: Water Research. 2008; vol. 42, no. 14, pp. 3961-3971

Novel modes of oestrogen receptor agonism and antagonism by hydroxylated and chlorinated biphenyls, revealed by conformation-specific peptide recognition patterns. Andreasen, P, Sumbayev, VV, Jensen, JK, Hansen, JA, I: Molecular and Cellular Endocrinology. 2008; vol. 287 , issues 1-2, pp. 30-39

Online pre-purification for the continuous enzymatic interesterification of bulk fats containing omega-3 oil. Ibrahim, NA, Nielsen, ST, Wigneswaran, V, Zhang, H, Xu, X, I: Journal of the American Oil Chemists' Society. 2008; vol. 85, pp. 95-98

Optical properties of graphene antidot lattices. Garm Pedersen, T, Flindt, C, Pedersen, J, Jauho, AP, Mortensen, NA, Pedersen, K, I: Physical Review B. 2008; vol. 77, pp. 245431

Optimal control design of NMR and dynamic nuclear polarization experiments using monotonically convergent algorithms. Maximov, I, Tosner, Z, Nielsen, NC, I: Journal of Chemical Physics. 2008; vol. 128, pp. 184505

Overexpression of protease nexin-1 mRNA and protein in oral squamous cell carcinomas. Andreasen, P, Gao, S, Dabelsteen, E, Krogdahl, A, Sørensen, JA, Kousted, TM, I: Oral Oncology. 2008; vol. 44, pp. 309-313

Palladium-catalyzed intermolecular ene-yne coupling: Development of an atom-efficient Mizoroki-Heck-type reaction. Lindhardt, AT, Mantel, MLH, Skrydstrup, T, I: Angewandte Chemie - International Edition. 2008; vol. 47, no. 14, pp. 2668-2672

Peptide Aggregation and Pore Formation in a Lipid Bilayer: A Combined Coarse-Grained and All Atom

Molecular Dynamics Study. Thøgersen, L, Schiøtt, B, Vosegaard, T, Nielsen, NC, Tajkhorshid, E, I: Biophysical Journal. 2008; vol. 95, pp. 4337-4347

Perylene Attached to 2'-Amino-LNA: Synthesis, Incorporation into Oligonucleotides, and Remarkable Fluorescence Properties in Vitro and in Cell Culture. Astakhova, IV, Korshun, VA, Jahn, K, Kjems, J, Wengel, J, I: Bioconjugate Chemistry. 2008; vol. 19 (10), pp. 1995-2007

pH dependent adsorption and conformational change of ferritin studied on metal oxide surfaces by a combination of QCM-D and AFM. Hemmersam, AG, Rechendorf, K, Besenbacher, F, Kasemo, B, Sutherland, D, I: Journal of Physical Chemistry C. 2008; vol. 112, pp. 4180-4186

Phase Behavior and Microstructure of C12E5 Nonionic Microemulsions with Chlorinated Oils. Deen, R, Pedersen, JS, I: Langmuir. 2008; vol. 24, pp. 3111-3117

Phonon properties in narrow gap FeSi and $FeSb_2$ single crystals. Racu, AM, Menzel, D, Schoenes, J, Marutzky, M, Johnsen, S, Iversen, BB, I: Journal of Applied Physics. 2008; vol. 103, pp. 07C9123

Phospholipase C-catalyzed sphingomyelin hydrolysis in a membrane reactor for ceramide production. Zhang, L, Liang, S, Hellgren, L, Jonsson, GE, Xu, X, I: Journal of Membrane Science. 2008; vol. 325, pp. 895-902

Physicoenzymatic Production of Monoacylglycerols Enriched with Very Long Chain Polyunsaturated Fatty Acids. Pawongrat, R, Xu, X, H-Kittikun, A, I: Journal of the Science of Food and Agriculture. 2008; vol. 88, pp. 256-262

Plasminogen activator inhibitor-1 (PAI-1): A molecule at the crossroads to cell survival or cell death. Andreasen, P, Kietzmann, T, I: Thrombosis and Haemostasis. 2008; vol. 100, no. 12, pp. 965-968

Plasmon hybridisation in stacked double gold rings with reduced symmetry. Larsson, E, Hao, F, Eurenius, L, Olsson, E, Nordlander, P, Sutherland, D, I: Small. 2008; vol. 4, no. 10, pp. 1630-1634

Point defects in SiGe alloys: Structural guessing basedon electronic transition analysis. Mesli, A, Kruszewski, P, Dobaczewsi, L, Kolkovsky, V, Nylandsted Larsen, A, Abrosimov, NV, I: Journal of Materials Science: Materials in Electronics. 2008; vol. 19, pp. S115–S121

Poly(p-phenylenevinylene) derivatives containing electron-transporting 1,10-phenanthroline segments. Yu, D, Zhu, K, Kristensen, PK, Garm Pedersen, T, Wimmer, R, I: Polymer Preprints. 2008; vol. 48(2), pp. 105

Posttranslational modification and proteolytic processing of urinary osteopontin. Christensen, B, Petersen, TE, Sørensen, ES, I: Biochemical Journal. 2008; vol. 411, pp. 53-61

Preclinical studies to predict efficacy of vascular changes induced by combretastatin a-4 disodium phosphate in patients. Nielsen, T, Murata, R, Maxwell, RJ, Stødkilde-Jørgensen, H, Østergaard, L, Horsman, MR, I: International Journal of Radiation: Oncology - Biology - Physics. 2008; vol. 70, no. 3, pp. 859-866

Predictive factors for response and prognostic factors for long-term survival in consecutive, single institution patients with locally advanced and/or metastatic transitional cell carcinoma following cisplatin-based chemotherapy. Jessen, C, Agerbaek, M, Maase, H, I: Acta Oncologica. 2008; pp. 1-7

Preparation of ascorbyl CLA ester with improved volumetric productivity by an ionic liquid-based reaction system. Chen, B, Guo, Z, Let, MB, Lue, BM, Xu, X, I: Organic & Biomolecular Chemistry. 2008; vol. 6, pp. 3196-3201

Proton irradiation of germanium isotope multilayer structures. Schneider, S, Bracht, H, Petersen, MC, Hansen, JL, Nylandsted Larsen, A, I: Journal of Applied Physics. 2008; vol. 103, pp. 033517

Protons and how they are transported by proton pumps. Buch-Pedersen, MJ, Pedersen, BP, Nissen, P, Palmgren, M, I: Pflügers Archiv: European Journal of Physiology. 2008; vol. 457 (3), pp. 573-579

Quantised electron states in nearly depleted hexagonal nanowires. Fisker, C, Garm Pedersen, T, I: Nanotechnology. 2008; vol. 19, pp. 115704

Quantitative Analysis of Constituents in Heavy Fuel Oil by 1H Nuclear Magnetic Resonance (NMR) Spectroscopy and Multivariate Data Analysis. Nielsen, KME, Dittmer, J, Malmendal, A, Nielsen, NC, I: Energy & Fuels. 2008; vol. 22, no. 6, pp. 4070–4076

Radicals by Design. Croft, AK, Lindsay, K, Renaud, P, Skrydstrup, T, I: Chimia. 2008; vol. 62, pp. 735

Reactions of ferrous neuroglobin and cytoglobin with nitrite under anaerobic conditions. Petersen, MG, Dewilde, S, Fago, A, I: Journal of Inorganic Biochemistry. 2008; vol. 102, pp. 1777-1782

Publications

Reactivity of LiBH4: In Situ Synchrotron Radiation Powder X-ray Diffraction Study. Mosegaard, L, Møller, B, Jørgensen, JE, Filinchuk, Y, Cerenius, Y, Hanson, JC, Dimasi, E, Besenbacher, F, Jensen, TR, I: Journal of Physical Chemistry C. 2008; vol. 112, pp. 1299-1303

Reactor design for in situ X-ray scattering studies of nanoparticle formation in supercritical water syntheses. Bremholm, M, Jensen, H, Iversen, SB, Iversen, BB, I: Journal of Supercritical Fluids. 2008; vol. 44, pp. 385-390

Recent STM, DFT and HAADF-STEM studies of sulfide-based hydrotreating catalysts: Insight into mechanistic, structural and particle size effects. Besenbacher, F, Brorson, M, Clausen, BS, Helveg, S, Hinnemann, B, Kibsgaard, J, Lauritsen, JV, Moses, PG, Nørskov, JK, Topsøe, H, I: Catalysis Today. 2008; vol. 130, pp. 86-96

Redirection of the reaction between activated protein C and a serpin to the substrate pathway. Andreasen, P, Komissarov, AA, Declerck, PJ, Kamikubo, Y, Zhou, A, Gruber, A, I: Thrombosis Research. 2008; pp. 397-404

Reorientation of OH^- in Water. Thøgersen, J, Jensen, SK, Petersen, C, Keiding, SR, I: Chemical Physics Letters. 2008; vol. 466, pp. 1-5

Resolution Enhancement in Solid-State NMR of Oriented Membrane Proteins by Anisotropic Differential Linebroadening. Vosegaard, T, Bertelsen, K, Pedersen, JM, Thøgersen, L, Schiøtt, B, Tajkhorshid, E, Skrydstrup, T, Nielsen, NC, I: Journal of the American Chemical Society. 2008; vol. 130, pp. 5028-5029

Restructuring of cobalt nanoparticles induced by formation and diffusion of monodisperse metal-sulfur complexes. Kibsgaard, J, Morgenstern, K, Lægsgaard, E, Lauritsen, JV, Besenbacher, F, I: Physical Review Letters. 2008; vol. 100, no. 11, pp. 116104

Scaling behavior of the surface roughness of platinum films grown by oblique angle deposition. Dolatshahi-Pirouz, A, Hovgaard, MB, Rechendorff, K, Foss, M, Besenbacher, F, I: Physical Review B. Condensed Matter and Materials Physics. 2008; vol. 77, pp. 115427

Scanning Probe Methods. Besenbacher, F, Lauritsen, JV, Vang, RT, I: Handbook of Heterogeneous Catalysis : Eds. G. Ertl ; H. Knözinger ; F. Schüth ; J. Weitkamp. Wiley. 2008;vol. 2

Scanning tunneling microscopy and spectroscopy studies of individual lander molecules anchored on a copper oxide nanotemplate. Naitoh, Y, Rosei, F, Gourdon, A, Lægsgaard, E, Stensgaard, I, Joachim, C, Besenbacher, F, I: Journal of Physical Chemistry C. 2008; vol. 112, pp. 16118-16122

Scanning tunneling microscopy as a tool to study catalytically relevant model systems. Vang, RT, Lauritsen, JV, Lægsgaard, E, Besenbacher, F, I: Chemical Society Reviews. 2008; vol. 37, pp. 2191-2203

Second-harmonic generation from ZnO nanowires. Pedersen, K, Fisker, C, Garm Pedersen T, I: Physica Status Solidi. C, Current topics in solid state physics. 2008; vol. 5 (8), pp. 2671-2674

Segmentation of dynamic contrast enhanced magnetic resonance imaging data. Nielsen, T, Mouridsen, K, Maxwell, RJ, Stødkilde-Jørgensen, H, Østergaard, L, Horsman, MR, I: Acta Oncologica. 2008; vol. 47, no. 7, pp. 1265-70

Sensitivity enhancement in natural-abundance solid-state 33S MAS NMR spectroscopy employing adiabatic inversion pulses to the satellite transitions. Hansen, MR, Brorson, M, Bildsøe, HK, Skibsted, J, Jakobsen, HJ, I: Journal of Magnetic Resonance. 2008; vol. 190, pp. 316-326

Sequential C-Si Bond Formations from Diphenylsilane: Application to Silanediol Peptide Isostere Precursors. Nielsen, L, Skrydstrup, T, I: Journal of the American Chemical Society. 2008; vol. 130, no. 39, pp. 13145–13151

Shedding light on dark plasmons in gold nanorings. Hao, F, Ali, T, Sutherland, D, Nordlander, P, Larsson, EM, I: Chemical Physics Letters. 2008; no. 458, pp. 262-266

Shielding of Sleeping Beauty DNA Transposon-delivered Transgene Cassettes by Heterologous Insulators in Early Embryonal Cells. Dalsgaard, T, Moldt, B, Sharma, N, Wolf, G, Schmitz, A, Pedersen, FS, Mikkelsen, JG, I: Molecular Therapy. 2008; vol. 17, no. 1, pp. 121-130

Sintering of cobalt nanoclusters on Ag(111) by sulfur: Formation of one-, two-, and three-dimensional cobalt sulfide. Morgenstern, K, Lægsgaard, E, Besenbacher, F, I: Surface Science. 2008; vol. 602, pp. 661-670

Slow desiccation improves dehydration tolerance and accumulation of compatible osmolytes in earthworm cocoons (Dendrobaena octaedra Savigny). Petersen, CR, Holmstrup, M, Malmendal, A, Bayley, M, Overgaard, J, I: Journal of Experimental Biology. 2008; vol. 211, no. 12, pp. 1903-10

SmI2-promoted intra- and intermolecular C-C bond formation with chiral N-acyl oxazolidinones. Taaning, R, Thim, L, Karaffa, J, Campaña, AG, Hansen, AM, Skrydstrup, T, I: Tetrahedron. 2008; vol. 64, pp. 11884

Solution Structure of C-Terminal Escherichia coli Translation Initiation Factor IF2 by Small-Angle X-ray Scattering. Rasmussen, LCV, Oliveira, CLP, Jensen, JM, Pedersen, JS, Sperling-Petersen, HU, Mortensen, KK, I: Biochemistry. 2008; vol. 47, no. 20, pp. 5590–5598

Solvent response to solute photo-dissociation. Petersen, C, Jensen, SK, Thøgersen, J, Keiding, SR, Sassi, P, I: Physical Chemistry Chemical Physics. 2008; vol. 10, pp. 990-995

Spatial and temporal changes in the morphology of preosteoblastic cells seeded on microstructured tantalum surfaces. Justesen, J, Lorentzen, M, Andersen, LK, Hansen, O, Chevallier, J, Modin, C, Füchtbauer, A, Foss, M, Besenbacher, F, Pedersen, FS, I: Journal of Biomedical Materials Research. Part A. 2008

Spatial and Temporal Electrochemical Control of Singlet Oxygen Production and Decay in Photosensitized Experiments. Ijeri, V, Daasbjerg, K, Ogilby, PR, Poulsen, L, I: Langmuir. 2008; vol. 24, pp. 1070-1079

Specificity of Watson-Crick Base Pairing on a Solid Surface Studied at the Atomic Scale. Otero Martin, R, Xu, W, Lukas, M, Kelly, REA, Lægsgaard, E, Stensgaard, I, Kjems, J, Kantorovich, LN, Besenbacher, F, I: Angewandte Chemie - International Edition. 2008; vol. 47, pp. 9673-9676

Spectroscopic Evidence for the Existence of an Obligate Pre-Fibrillar Oligonomer during Glucagon Fibrillation. Christensen, PA, Pedersen, JS, Christiansen, G, Otzen, D, I: FEBS Letters. 2008; no. 582, pp. 1341-1345

Stability of the three tetracoordinated dianions Ni(CN)2-4 , Cr(SCN)2-4 , and Cu(N3)2-4. Drenck, K, Jensen, F, Olsen, J, Nielsen, SB, I: Chemical Physics. 2008; vol. 353, pp. 189-192

Strain-induced conduction-band spin splitting in GaAs from first-principles calculations. Chantis, AN, Cardona, M, Christensen, NE, Smith, DL, van Schilfgaarde, M, Kotani, T, Svane, A, Albers, RC, I: Physical Review B. Condensed Matter and Materials Physics. 2008; vol. 78, pp. 075208

Structural and sensing properties of nanocrystalline SnO2 films deposited by spray pyrolysis from a SnCl2 precursor. Gaiduk, PI, Kozjevko, AN, Prokopjev, SL, Tsamis, C, Nylandsted Larsen, A, I: Applied Physics A: Materials Science & Processing. 2008; vol. 91, pp. 667-670

Structural characterization of strained silicon grown on a SiGe buffer layer. Jang, JH, Phen, MS, Gerger, A, Jones, KS, Hansen, JL, Nylandsted Larsen, A, Craciun, C, I: Semiconductor Science and Technology. 2008; vol. 23, pp. 035012

Structural environments for boron and aluminum in alumina-boria catalysts and their precursors from 11B and 27Al single- and double-resonance MAS NMR experiments. Hansen, MR, Jakobsen, HJ, Skibsted, J, I: Journal of Physical Chemistry C. 2008; vol. 112, pp. 7210-7222

Structural insight into the function of myelin basic protein as a ligand for integrin $\alpha M\beta 2$. Stapulionis, R, Oliveira, C, Gjelstrup, MC, Pedersen, JS, Hokland, M, Hoffmann, SV, Poulsen, K, Jacobsen, C, Vorup-Jensen, T, I: Journal of Immunology. 2008; vol. 180, pp. 3946-3956

Structure and reactivity of a model catalyst alloy under realistic conditions. Westerström, R, Wang, J, Ackermann, MD, Gustafson, J, Resta, A, Mikkelsen, A, Andersen, JN, Lundgren, E, Balmes, O, Torelles, X, Frenken, JWM, Hammer, B, I: Journal of Physics: Condensed Matter. 2008; vol. 20, pp. 184018

Structure of activated thrombin-activatable fibrinolysis inhibitor, a molecular link between coagulation and fibrinolysis. Sanglas, L, Valnickova, Z, Arolas, JL, Pallarés, I, Guevara, T, Solà, M, Kristensen, T, Enghild, JJ, Aviles, FX, Gomis-Rüth, FX, I: Molecular Cell. 2008; vol. 31, no. 4, pp. 598-606

Structure of and influence of a tick complement inhibitor on human complement component 5. Fredslund, F, Laursen, NS, Roversi, P, Jenner, LB, Oliveira, C, Pedersen, JS, Nunn, M, Lea, SM, Richard, D, Sottrup-Jensen, L, Andersen, GR, I: Nature Immunology. 2008; vol. 9, no. 7, pp. 753-760

Structures of ionic liquids dictate the conversion and selectivity of enzymatic glycerolysis: theoretical characterization by COSMO-RS. Chen, B, Guo, Z, Tan, T, Xu, X, I: Biotechnology and Bioengineering. 2008; vol. 99, pp. 18-29

Substrate Binding and Formation of an Occluded State in the Leucine Transporter. Celik, L, Schiøtt, HB, Tajkhorshid, E, I: Biophysical Journal. 2008; vol. 94, no. 5, pp. 1600

Surface oxide formation during corona discharge treatment of AA 1050 Aluminium Surfaces. Minzari, D, Møller, PCF, Kingshott, P, Becker-Christensen, J, Højslet Christensen, L, Ambat, R, I: Corrosion Science. 2008; vol. 50, no. 5, pp. 1321-1330

Surface synthesis of 2D branched polymer nanostructures. Weigelt, S, Busse, CW, Bombis, C, Knudsen, MM, Gothelf, KV, Lægsgaard, E, Besenbacher, F, Linderoth, TR, I: Angewandte Chemie - International Edition. 2008; vol. 47, pp. 4406-4410

Surface-sensitive conductance measurements. Hofmann, P, Wells, J, I: Journal of Physics: Condensed Matter. 2008; vol. 21, pp. 013003

Surface-sensitive conductance measurements on clean and stepped semiconductor surfaces: Numerical simulations of four point probe measurements. Wells, J, Kallehauge, J, Hofmann, P, I: Surface Science. 2008; vol. 602, pp. 1742-1749

Surfactant-free synthesis of nickel nanoparticles in near-critical water. Hald, P, Bremholm, M, Iversen, SB, Iversen, BB, I: Journal of Solid State Chemistry. 2008; vol. 181(10), pp. 2681-2683

Synchrotron X-ray Charge Density Study of Coordination Polymer Co3(C8H4O4)4(C4H12N)2(C5H11NO)3 at 16 K. Clausen, HF, Overgaard, J, Chen, YS, Iversen, BB, I: Journal of the American Chemical Society. 2008; vol. 130, pp. 7988-7996

Synthesis and analysis of hollow SnO2 nanoislands. Gaiduk, PI, Hansen, JL, Nylandsted Larsen, A, I: Applied Physics Letters. 2008; vol. 92 (19), pp. 193112

Synthesis and characterization of conventional and mesoporous Ga-MFI for ethane dehydrogenation. Leth, KT, Rovik, AK, Holm, MS, Brorson, M, Jakobsen, HJ, Skibsted, J, Christensen, CH, I: Applied Catalysis A: General. 2008; vol. 348, pp. 257-265

Synthesis of 2’-O-modified adenosine building blocks and application for RNA interference. Odadzica, D, Bramsen, JB, Bus, C, Kjems, J, Engelse, JW, I: Bioorganic & Medicinal Chemistry. 2008; vol. 16. pp. 518

The augmented Roothaan-Hall method for optimizing Hartree-Fock and Kohn-Sham density matrices. Høst, S, Olsen, J, Jansik, B, Thøgersen, L, Jørgensen, P, Helgaker, T, I: Journal of Chemical Physics. 2008; vol. 129, pp. 124106

The conductivity of Bi(111) investigated with nanoscale four point probes. Wells, J, Handrup, K, Kallehauge, J, Gammelgaard, L, Bøggild, P, Balslev, MB, Hansen, JE, Petersen, PRE,

Publications

Hofmann, P, I: Journal of Applied Physics. 2008; vol. 104, pp. 053717

The crystal structure of TAFI provides the structural basis for its intrinsic activity and the short half-life of TAFIa. Anand, K, Pallares, I, Valnickova, Z, Christensen, T, Vendrell, J, Wendt, KU, Schreuder, HA, Enghild, JJ, Avilés, FX, I: Journal of Biological Chemistry. 2008; Vol. 283, issue 43, pp. 29416-29423

The folding of human aEC-sod and iEC-sod is an intracellular event. Petersen, SV, Kristensen, T, Petersen, JS, Ramsgaard, L, Oury, TD, Crapo, JD, Nielsen, NC, Enghild, JJ, I: Journal of Biological Chemistry. 2008;Vol. 283, issue 22, pp- 15031-15036

The Role of Interstitial Sites in the Ti3d Defect State in the Band Gap of Titania. Wendt, S, Sprunger, P, Lira, E, Madsen, GKH, Li, Z, Hansen, JØ, Matthiesen, J, Blekinge-Rasmussen, A, Lægsgaard, E, Hammer, B, Besenbacher, F, I: Science. 2008; vol. 320, pp. 1755-1759

The three-dimensional structure of CsmA: A small antenna protein from the green sulfur bacterium Chlorobium tepidum. Pedersen, MØ, Underhaug, J, Dittmer, J, Miller, M, Nielsen, NC, I: FEBS Letters. 2008; vol. 582, no. 19, pp. 2869-2874

The transfer of heavy chains from bikunin proteins to hyaluronan requires both TSG-6 and HC2. Sanggaard, KW, Sonne-Schmidt, CS, Hansen, TPK, Lorentzen, KA, Wisniewski, HG, Thøgersen, I, Enghild, JJ, I: Journal of Biological Chemistry. 2008; Vol. 283, issue 27, pp. 18530-18537

Theoretical analysis of the Faraday effect in semiconducting zigzag carbon nanotubes. Zarifi, A,Garm Pedersen, T, I: Physical Review B. 2008; vol. 77, pp. 85409

Thermal decomposition of monocalcium aluminate decahydrate (CaAl2O4.10H2O) investigated by in-situ synchrotron X-ray powder diffraction, thermal analysis and 27Al, 2H MAS NMR spectroscopy. Christensen, AN, Jensen, TR, Lebech, B, Hanson, JC, Jakobsen, HJ, Skibsted, J, I: Dalton Transactions. 2008; pp. 455-462

Thermal switching of the electrical conductivity of Si(111)(root 3 x root 3)Ag due to a surface phase transition. Wells, J, Kallehauge, J, Hofmann, P, I: Journal of Physics: Condensed Matter. 2008; vol. 20, pp. 339802

Thermally stable thermoelectric Zn_4Sb_3 by zone-melting synthesis. Pedersen, BL, Iversen, BB, I: Applied Physics Letters. 2008; vol. 92, issue 16, pp. 161907

Thermodynamics and mechanism of cutinase stabilization by trehalose. Baptista, RP, Pedersen, SH, Cabrita, GJM, Otzen, D, Cabral, JM, Melo, EP, I: Biopolymers. 2008; vol. 89, pp. 538-547

Thermodynamics of oxygenation-linked proton and lactate binding govern the temperature sensitivity of O2 binding in crustacean (Carcinus maenas) hemocyanin. Weber, RE, Behrens, H, Malte, H, Fago, A, I: Journal of Experimental Biology. 2008; vol. 211, pp. 1057-1062

Time-resolved in situ small-angle X-ray scattering study of silica particle formation in nonionic water-in-oil microemulsions. Riello, P, Mattiazzi, M, Pedersen, JS, Benedetti, A, I: Langmuir. 2008; vol. 24, pp. 5225-5228

Time-Resolved Singlet Oxygen Phosphorescence Measurements from Photosensitized Experiments in Single Cells: The Effects of Oxygen Diffusion and Oxygen Concentration. Hatz, S, Poulsen, L, Ogilby, PR, I: Photochemistry and Photobiology. 2008; vol. 84, pp. 1284-1290

Torsional Barriers and Equilibrium Angle of Biphenyl: Reconciling Theory with Experiment. Johansson, MP, Olsen, J, I: Journal of Chemical Theory and Computation. 2008; vol. 4, pp. 1460-1471

Toward Reliable Gold Nanoparticle Patterning On Self-Assembled DNA Nanoscaffold. Sharma, J, Chhabra, R, Andersen, CS, Gothelf, KV, Yan, H, Liu, Y, I: Journal of the American Chemical Society. 2008; vol. 130, pp. 7820-7821

Transfer of inter-alpha -inhibitor heavy chains to hyaluronan by surface-linked hyaluronan-TSG-6 complexes. Colon, E, Shytuhina, A, Cowman, MK, Band, PA, Sanggaard, KW, Enghild, JJ, Wisniewski, HG, I: International Journal of Biological Chemistry. 2008;doi 10.1074/jbc.M807183200

Translation elongation factor eEF1A binds to a novel myosin binding protein-C-like protein. Mansilla, F, Dominguez, CAG, Yeadon, JE, Corydon, TJ, Burden, SJ, Knudsen, CR, I: Molecular and Cellular Biology. 2008; vol. 105,(3), pp. 847-858

Triple Oscillating Field Technique for Accurate Distance Measurements by Solid-State NMR. Nielsen, NC, Khaneja, N, I: Journal of Chemical Physics. 2008; vol. 128, pp. 015103

TSG-6 transfers proteins between glycosaminoglycans via a Ser28-mediated covalent catalytic mechanism. Sanggaard, KW, Sonne-Schmidt, CS, Hansen, TPK, Kristensen, T, Wisniewski, HG, Thøgersen, I, Enghild, JJ, I: International Journal of Biological Chemistry. 2008; vol. 283 (49), pp. 33919-33926

Two-Dimensional Supramolecular Nanopatterns Formed by the Coadsorption of Guanine and Uracil at the Liquid/SolidInterface. Mamdouh, W, E. A. Kelly, R, Dong, M, N. Kantorovich, L, Besenbacher, F, I: Journal of the American Chemical Society. 2008; vol. 130, pp. 695-702

Understanding the disorder of the DNA base cytosine on the Au(111) surface. Kelly, RE, Lukas, M, Kantorovich, LN, Otero Martin, R, Xu, W, Mura, M, Lægsgaard, E, Stensgaard, I, Besenbacher, F, I: Journal of Chemical Physics. 2008; vol. 129, pp. 184707

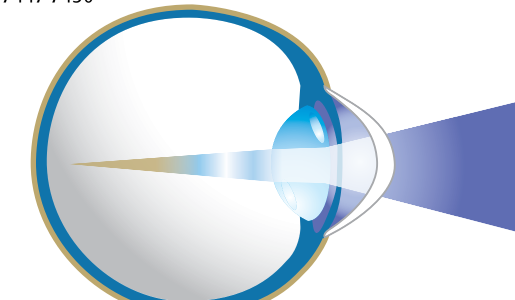
Valence electronic properties of n-channel organic materials based on fluorinated derivatives of perylene diimides. Dou, W, Dandan, G, Song, F, Li, N, Zhang, H, Li, H, He, P, Chen, H, Shining, B, Hofmann, P, I: Journal of Chemical Physics. 2008; vol. 128, no. 24, pp. 244711

Visualization of the eEF2-80S ribosome transition-state complex by cryo-electron microscopy. Nilsson, J, Sengupta, J, Gursky, R, Kjeldgaard, M, Nissen, P, Frank, J, I: Journal of Molecular Biology. 2008; vol. 382, no. 1, pp. 179-187

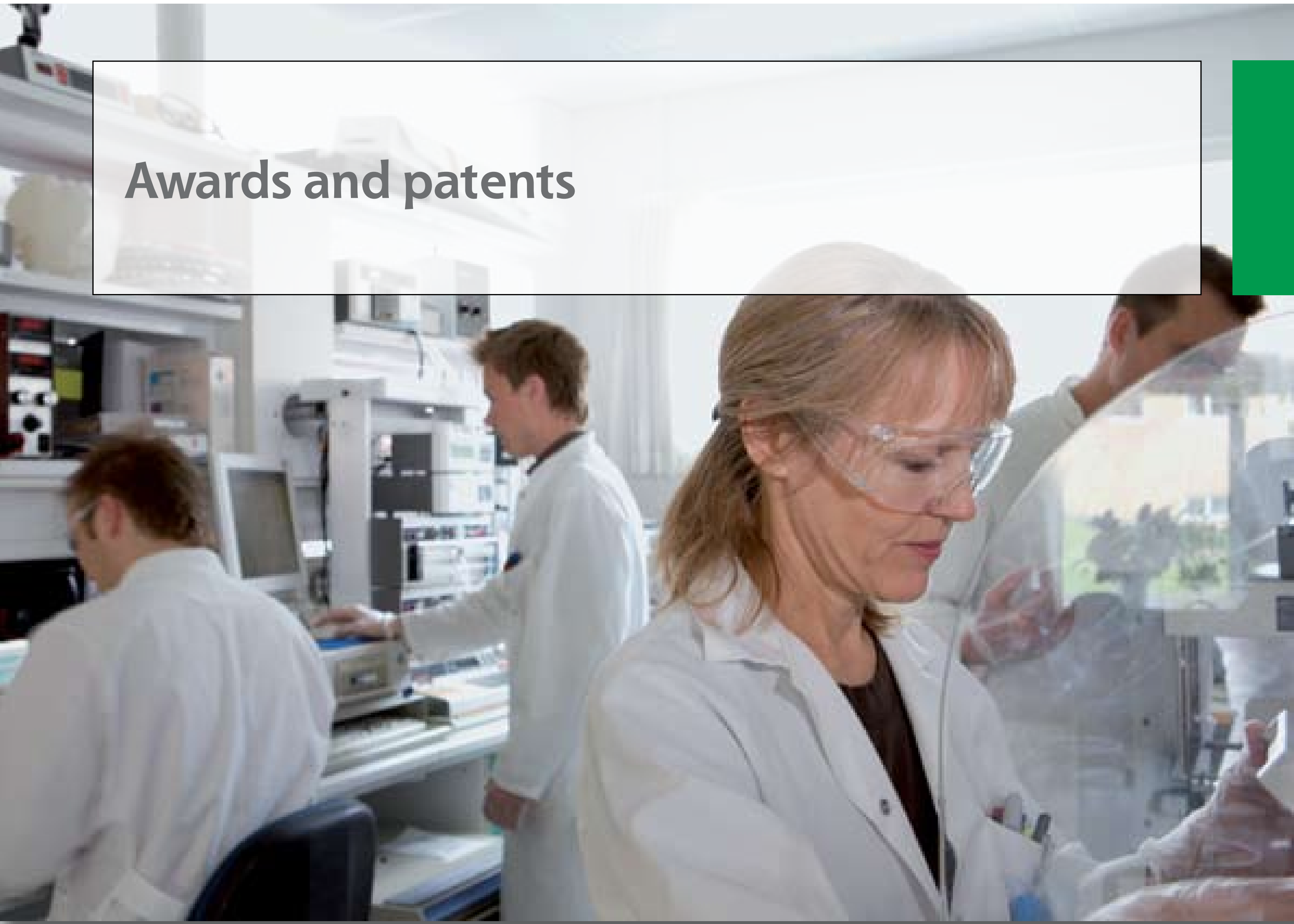
Water distribution and microstructure in enhanced pork. Bertram, HC, Meyer, RL, Wu, Z, Andersen, HJ, I: Journal of Agricultural and Food Chemistry. 2008; vol. 56, no. 16, pp. 7201-7207

We find them here, we find them there: Functional bacterial amyloid. Otzen, D, Nielsen, PH, I: Cellular and Molecular Life Sciences. 2008; vol. 65, pp. 910-927

α-Cr2O3 template-texture effect on α-A12O3 thin-film growth. Eklund, P, Madana SG, Sillassen, MB, Bøttiger, J, I: Thin Solid Films. 2008; no. 516, pp. 7447-7450



Awards and patents



Awards

Flemming Besenbacher
Bird, Stewart, Lightfoot (BSL) Lectureship Award

Hans Jakob Askou
Siemens Award

Jakob Kibsgaard
Research Fight Award on Communication of Research

Jan Skov Pedersen
Carlsberg's Chemistry Prize

Jens Vinge Nygaard
Best presentation at i-TechPartner Forum by MedTech, Coimbra, Portugal

Kurt V. Gothelf
The Knud Lind Larsen Prize

Leif Østergaard
EliteForsk Award

Lone Tang
Poster Award at the Biofilm III Conference, Munich, Germany

Poul Nissen
EliteForsk Award

Rasmus Neergaard Jakobsen
Siemens Award

Sigrid Weigelt
Aarhus University Research Foundation PhD Prize

Sissel Juhl Jensen
Siemens Travel Stipend

Sofie Kastbjerg, Søren Porsgaard, and Jakob Arendt Rasmussen
Grundfos Challenge Innovation Award

Toke K. Hansen
Best Poster Award at the AU-FOODNET Conference, Aarhus, Denmark

Wei Xu
Chinese Government Award for Outstanding Self-financed Students Abroad

Patents

B.B. Iversen, M. Bremholm, P. Hald, M. Felicissomo, S.B. Iversen, M.A.H.Mamakhel, Phase pure crystalline nanoparticles and a method of manufacturing thereof, priority application PA 2008 01810

M.R. Duch, F.S. Pedersen, S. Bahrami, P.V. Fredsted, C. Wiuf, L. Østergaard, M. Tolstrup, HIV-1 envelope polypeptides for HIV vaccine, priority application PA 2008 01184

M.R. Duch, F.S. Pedersen, S. Bahrami, L. T. Nielsen, O. M. Søgaard, J. Melchjorsen, L. Østergaard, M. Tolstrup, A.L. Laursen, Multiplexed peptide-cytokine vaccination, priority application PA 2008 01553

F.S. Pedersen, S. Bahrami, Retroviral delivery of synthetic gene cassettes, priority application PA 2008 01320

C.S. Søndergaard, M. Kristensen, K. Hansen, A. F. Baurichter, B.F. Skipper, G.K. Hansen, Radiation Detector with Doped Optical Guides, priority application PA 2008 01642

Invited talks

Andreasen, Peter, New principles for pharmacological intervention with the plasminogen activation system, Plasminogen Activation and Extracellular Proteolysis, Gordon Research Conferences, USA

Balling, Peter, Femtosecond laser ablation of single-crystal aluminum, 6th International Conference on Photo-excited Processes and Applications, ICPEPA 6, Sapporo, Japan

Balling, Peter, Short-pulse metal structuring: A method for modifying surface adhesion properties, Photonics West, San Jose, CA, USA

Balling, Peter, Ultra-short-pulse excitation of matter, 8th Nordic Femtochemistry Meeting, Fuglsøcentret, Knebel, Denmark

Baatrup, Erik, Silver nanoparticles impair vital life functions in fish, Eigtveds Pakhus, Sundhedsstyrelsen, Copenhagen, Denmark

Becker-Christensen, Jacob, Catliq - A Study of a Catalyst, iNANO Autumn School 2008, Fuglsøcentret, Knebel, Denmark

Besenbacher, Flemming, Biomolecules studied by AFM: From the nanometer to the micrometer length scale, iBIO conference, China

Besenbacher, Flemming, Catalytic model systems and surface reactivity studied at the atomic scale by high-resolution, fast-scanning STM, 13th Nordic Symposium on Catalysis, Competence Centre for Catalysis (KCK) and The Swedish National Committee for Chemistry, Gothenburg, Sweden

Besenbacher, Flemming, Catalytic model systems and surface reactivity studied at the atomic scale by high-resolution, fast-scanning STM, Grand Challenges in Electron Chemistry and Catalysis at Interfaces Summer Workshop, Santa Barbara, CA, USA

Besenbacher, Flemming, Catalytic model systems and surface reactivity studied at the atomic scale by high-resolution, fast-scanning STM, University of Wisconsin-Madison, Bird-Stewart-Lightfoot lectureship award, Madison, WI, USA

Besenbacher, Flemming, Catalytical model systems and surface reactivity studied by high-resolution, video-rate STM, Nanotechnology International Forum, Moscow, Russia

Besenbacher, Flemming, Den lille forskel – Nanoteknologiens muligheder i tilpasningen til klimaforandringer, Aarhus University, Folkeuniversitet i Aarhus, Denmark

Besenbacher, Flemming, Dynamics of Nanostructures on surfaces revealed by high-resolutin, fast-scanning STM, Harvard, Rowland Institute, MA, USA

Besenbacher, Flemming, Dynamics of nanostructures on surfaces revealed by high-resolution, fast-scanning STM, European Microscopy Congress 2008, Aachen, Germany

Besenbacher, Flemming, Dynamics of nanostructures on surfaces revealed by high-resolution, fast-scanning STM, Nanocenter in Shanghai, China

Besenbacher, Flemming, From Nanoscience to Nanotechnology, Huashong Normal University, China

Besenbacher, Flemming, From Nanoscience to Nanotechnology, Zhejiang University, China

Besenbacher, Flemming, High-resolution scanning tunneling microscopy studies of surface reactions on rutile $TiO_2(110)$, SPIE Conference Solar Hydrogen and Nanotechnology, San Diego,CA, USA

Besenbacher, Flemming, Hydrogen-samfundet - et nyt energisystem, Forskningens døgn, Aarhus, Denmark

Besenbacher, Flemming, Introduction to iNANO and dynamics of nanostructures on surfaces revealed by high-resolution, fast-scanning STM, Universität Osnabrück, Germany

Besenbacher, Flemming, Introduktion til nanovidenskab og nano-teknologi, Aarhus University, Folkeuniversitetet i Aarhus, Denmark

Besenbacher, Flemming, Nanoscience and Nanotechnology in the 21st Century, Temadag, Teknologisk Institut, Høje Tåstrup, Denmark

Besenbacher, Flemming, Nanotechnology, European Comission, Brussels, Belgium

Besenbacher, Flemming, Nanoteknologi – små har aldrig været større, HTX Tekniske Gymnasium Aarhus, Denmark

Besenbacher, Flemming, Nanoteknologi i fødevarefremstilling, Levnedsmiddelselskabets 50 års jubilæum: Det bedste af det bedste - Fødevarer de næste 50 år, Copenhagen, Denmark

Besenbacher, Flemming, Nanoteknologi som baggrund for den næste industrielle revolution, VLG-møde, Aarhus, Denmark

Besenbacher, Flemming, New Atomic-Scale Insights into Cluster-size, Promoter and Support

Effects of MoS2-based Hydrotreating Model Catalysts, ACS Spring Meeting, New Orleans, LA, USA

Besenbacher, Flemming, Organic molecules on surfaces studied by STM: Dynamics, chirality, organization and self-assembly, Peking University, China

Besenbacher, Flemming, Research Industry Cooperation - Research Centre Capabilities, Nanotech Northern Europe 2008, Copenhagen, Denmark

Besenbacher, Flemming, Self-assembly of DNA molecules on surfaces studied by STM: Dynamics, self-organisation, WC base pairing and DNA dolphins, TNT 2008, Oviedo, Spain

Besenbacher, Flemming, Self-assembly of Organic Molecules on Surfaces Studied by STM: Dynamics, Chirality and Self-Organization, AVS Meeting, Boston, MA, USA

Besenbacher, Flemming, Self-assembly of organic molecules on surfaces studied by STM: Dynamics, Chirality and self-organization, China-Denmark Symposium on Nanoscience, Beijing, China

Besenbacher, Flemming, Small is different: The reactivity of small nanostructures studied by STM, Tianjin University, China

Besenbacher, Flemming, SPM studies of DNA nanostructures and glucagon, EC-US Nanobiology Workshop, Italy

Birkedal, Henrik, Bone Nanostructure from SAXS: a New Data Analysis Method, Fifth Nordic Workshop on Scattering from Soft Matter, Trondheim, Norway

Birkedal, Henrik, The calcified byssus of the saddle oyster (Anomia sp.): A mineralized holdfast system containing calcite and aragonite, MRS spring meeting 2008, San Francisco, CA, USA

Birkedal, Victoria, Single molecule FRET microscopy of nucleic acids, Paris, France

Diekhöner, Lars, Atomistic description of nanoisland growth: Co on single crystal Cu surfaces" IUTAM-Symposium on Modelling Nanomaterials and Nanosystems, Aalborg, Denmark

Fago, Angela, NO, sprængstof og respiraton, U-days 2008, Åbent hus '08 på Naturvidenskab, Aarhus University, Aarhus, Denmark

Ferapontova, Elena, Biosensor platforms based on DNA and RNA nanoswitching architectures, Nanobased Sensors 2 Workshop, Odense, Denmark

Ferapontova, Elena, Electrochemical biosensors for small molecule detection: Pros and cons of enzyme- and nucleic-acid based assays for point-of-care diagnostics, FRONTIERS EU Research Meeting, Heraklion, Greece

Gothelf, Kurt Vesterager, Controlling Self-Assembly at the Nanoscale, iNASCON Fuglsøcentret, Knebel, Denmark

Gothelf, Kurt Vesterager, DNA Nanotechnology. MONET and iNANO PhD School, iNANO, Interdisciplinary Nanoscience Center at Aarhus University, Denmark

Gothelf, Kurt Vesterager, DNA Nanoteknologi. UNF, Aarhus University, Denmark

Gothelf, Kurt Vesterager, DNA-Programmed self-assembly of nanostructures, Ruprecht-Karls Universität Heidelberg, Germany

Gothelf, Kurt Vesterager, DNA-Programmed self-assembly of nanostructures, MOBIL-project, Jagiellonian University, Poland

Gothelf, Kurt Vesterager, DNA-Programmed self-assembly of nanostructures, MOBIL- project, Gdansk University, Poland

Gothelf, Kurt Vesterager, Formation of Nanostructures by DNA-Programmed Assembly and Conjugate Couplings, DNA14 - Nanoday, Prague, Czech Republic

Gothelf, Kurt Vesterager, Hvordan samler man nanobyggesten ved hjælp af den genetiske kode? U-Days, Aarhus University, Denmark

Gothelf, Kurt Vesterager, Nanokemi og molekylær arkitektur, Aarhus University, Folkeuniversitetet i Aarhus, Denmark

Invited talks

Gothelf, Kurt Vesterager, Nanoteknologi, Centre for Psychiatric Research, Aarhus University Hospital, Aarhus, Denmark

Gothelf, Kurt Vesterager, Nucleic Acid-Based Nanostructures and Biosensors, Knud Lind Larsen Symposium, Akademiet for de tekniske Videnskaber, Kgs. Lyngby, Denmark

Gothelf, Kurt Vesterager, Programmed Assembly of Molecules and Materials. China-Denmark Symposium on Nanoscience, Beijing, China

Gothelf, Kurt Vesterager, Programmeret sel-vorganisering af nanobyggesten, Aarhus Statsgymnasium, Denmark

Gothelf, Kurt Vesterager, Self-assembly and programmed reactions of DNA-conjugates, Kemisk Forenings Årsmøde, Odense, Denmark

Hammer, Bjørk, Activity of supported RhO_2 and PtO_2 nano-structures, COST D41, Paris, France

Hammer, Bjørk, Catalytic gold nano-particles. Academy of Science, Beijing, China

Hammer, Bjørk, Chemistry at surfaces, CAMD Summerschool 2008, DTU, Kgs. Lyngby, Denmark

Hammer, Bjørk, Fundamentals of catalysis by surfaces, Monet Autumn School, Fuglsøcenteret, iNANO, Interdisciplinary Nanoscience Center at Aarhus University, Denmark

Hammer, Bjørk, On the origin of the gap state on rutile TiO2(110), GOSPEL, Tübingen, Germany

Hammer, Bjørk, Oxygen chemisorption on reduced rutile TiO2(110), ICTAC-12, University of Sofia, Bulgaria

Hammer, Bjørk, Structure and activity of supported Au nano-clusters, Shanghai, Fudan University, China

Hammer, Bjørk, Understanding adsorption bond strengths at transition metal surfaces, films, and clusters. Tianjin, Tianjin University, China

Iversen, Anders, Bacterial Adhesion on Sol-Gel Surfaces, INTIME-6, Sæby, Denmark

Jakobsen, Hans Jørgen, Advancements in Natural Abundance 33S MAS NMR of Solids Including Sensitivity Enhancement and Characterization of Solid Solutions by NMR, 91st Canadian Society of Chemistry (CSC) Conferenc e, Symposium on Advances in Solid-State NMR, Edmonton, Alberta, National Ultrahigh Field NMR Facility for Solids, Ottawa, Canada

Jakobsen, Hans Jørgen, NHMFL Advisory Board Committee, Adviser on Solid-State NMR Instrumentation and Methods, Opponent/discussant. National High Magnetic Field Laboratory (NHMFL) Users Annual Meeting, University of Florida, Gainesville, FL, USA

Jakobsen, Hans Jørgen, Sensitivity Enhancement in Natural-Abundance Solid-State 33S MAS NMR by Population Transfer with Inversion Pulses to the Satellite Transitions, 29th Danish NMR Discussion Group Meeting, Nyborg, Denmark

Jakobsen, Hans Jørgen, Sensitivity Enhancement in Natural-Abundance Solid-State 33S MAS NMR by Population Transfer Using Inversion Pulses to the Satellite Transitions, Varian NMR Users Meeting 2008, Radboud University, Nijmegen, The Netherlands

Jakobsen, Hans Jørgen, Solid-State 14N, 33S, 87Rb, and 133Cs MAS NMR Studies of NH4+-Site Preferences in Solid Solutions of Some Inorganic Materials, 37th South Eastern Magnetic Resonance Conference - SEMRC 2008, Florida State University, Tallahassee, FL, USA

Jensen, Torben René, Energy materials for the future: Chemical reactions studied by in situ synchrotron radiation powder X-ray diffraction, 21th Annual User Meeting and the workshop New Directions for MAX-IV, Lund, Sweden

Jensen, Torben René, Hydrogen Storage Materials, Task 22, Det Internationale Energiagentur, Rome, Italy

Jensen, Torben René, Hydrogen-samfundet - et nyt energisystem, Viby Gymnasium, Denmark

Jensen, Torben René, Hydrogen-samfundet - et nyt energisystem, Viborg HTX, Denmark

Jensen, Torben René, Scientific programs and strategies concerning hydrogen storage and fuel cells in Scandinavia, 3rd International Funchy Workshop, European Activities in Hydrogen Technology Research, Dresden, Germany

Jensen, Torben René, Tetrahydridoboranates for hydrogen storage studied by in situ SR powder X-ray diffraction, 4th meeting of Nordic Center of Excellence on Hydrogen Storage Materials, Copenhagen, Denmark

Kjems, Jørgen, A proximal 5' splice site stimulates transcriptional initiation, ERASNET meeting, Krakow, Poland

Kjems, Jørgen, Design and application new types of nanomedicine. Nanotech Northern Europe, Copenhagen, Denmark

Kjems, Jørgen, Mechanisms and optimization for the cellular delivery of siRNAs and microRNA, Controlled release society meeting, Bristol, Great Britain

Kjems, Jørgen, Nanoscience and the Role of Nanotech in Biomedical Innovation. US-Danish Biomedical Innovation and Health Meeting, Invest in Denmark, Boston, MA, USA

Kjems, Jørgen, Nanotechnology: Outlook and prospects. Innovation Day, Danfoss, Nordborg, Denmark

Kjems, Jørgen, Optimization of siRNA function, in vivo delivery and therapeutic potential by chemical modifications and polymeric formulation, Antiviral Applications of RNA Interference, Costa Brava, Spain

Kjems, Jørgen, Optimization of siRNA function, in vivo delivery and therapeutic potential by chemical modifications and polymeric formulation, RNAi, Oxford, Great Britain

Kjems, Jørgen, Optimizing RNAi for therapeutic applications, NordForsk conference on RNA structure, function and therapeutics, Helsinki, Finland

Kjems, Jørgen, RNA therapeutics, I.C.G.E.B., Trieste, Italy

Kjems, Jørgen, RNA therapeutics, ESF outlook conference on RNA therapeutics, Lisbon, Portugal

Kjems, Jørgen, Selfassembled nanoparticles for biosensing and in vivo drug delivery, ESF Nanomedicine meeting, Costa Brava, Spain

Kjems, Jørgen, Selfassembled nanoparticles for biosensing and in vivo drug delivery, Nanotech Northern Europe, Copenhagen, Denmark

Kjems, Jørgen, siRNA delivery systems at iNANO, Alnylam, MA, USA

Kjems, Jørgen, siRNA delivery systems at iNANO, Kulmbach, Roche, Germany

Kjems, Jørgen, siRNA delivery, trafficking and gene Silencing using polymeric nanoparticles, Helsinki University, Finland

Kjems, Jørgen, siRNA delivery using nanocarrier systems, Chalmers University of Technology, Gothenburg, Sweden

Larsen, Arne Nylandsted, Epitaxial Thin-Film Silicon-Solar Cells with metallic surface- nanoparticles, Nanotech Northern Europe, Copenhagen, Denmark

Larsen, Arne Nylandsted, European Materials Research Society-MRS-Spring Meeting June 2008, Strasbourg, France

Larsen, Arne Nylandsted, Danish National Research Foundation Symposium: Renewable Energy Technologies, Copenhagen, Denmark

Linderoth, Trolle René, Adsorption and organisation of molecular moulds on Au(111). 4th pico-inside meeting, Krakow, Poland

Linderoth, Trolle René, Molecular Nanostructures on surfaces formed by organic reactions, Electron Controlled Chemical Lithography, ECCL COST, Lisbon, Portugal

Linderoth, Trolle René, Molecular organisation on surfaces studied by UHV-STM: Reactions, chirality and dynamics, 25th European Conference on Surface Science (ECOSS 25), Liverpool, Great Britain

Linderoth, Trolle René, Molecular Organisation on Surfaces Studied by UHV-STM: Reactions, Chirality and Dynamics, 22nd General conference of the Condensed Matter Division of the European Physical Societey (CMD22), Rome, Italy

Linderoth, Trolle René, Self-assembly of Hydrogen Bonded Molecular Moulds, 5th PICO INSIDE meeting, Madrid, Spain

Malmendal, Anders, Getting the necessary information from super-simple NMR. Structural Biology Network, Tällberg, Sweden

Malmendal, Anders, Temperature stress at the metabolite level, Metabo Meeting Metabolic Profiling Forum, Lyon, France

Malmendal, Anders, TOP-DOWN NMR—From fruit fly metabolomics to protein perturbomics, University College London, London, Great Britain

Malmendal, Anders, TOP-DOWN NMR—From metabolomics of temperature-stressed fruit flies to protein perturbomics, Lund University, Sweden

Mamdouh, Wael, Designing and Imaging DNA Nanostructures, The XXVII Conference on Solid State Physics and Materials Science & Workshop on Nanostructure Science in Solids and Biological Systems, The Egyptian Materials Research Society (Eg-MRS), Red Sea, Ain Soukhna, Egypt

Mamdouh, Wael, Fundamental Aspects of Scanning Probe Microscopy (SPM) and their Applications in Biology, Interdisciplinary Focus Meeting on Biophysical Methods Applied to RNA - EURASNET Workshop, Aarhus, Denmark

Mamdouh, Wael, Self-assembly of organic molecules on surfaces studies by STM: Dynamics, chirality and self-organization, The X. Annual Linz Winter Workshop, Advances in Single-Molecule Research for Biology & Nanoscience, University of Linz, Austria

Meyer, Rikke Louise, Biofilm set med nanobriller, Biologisk Instituts Årsmøde, Aarhus University, Denmark

Meyer, Rikke Louise, Combination of AFM and optical microscopy for studying bacterial adhesion, SPM in Life Sciences, Berlin, Germany

Meyer, Rikke Louise, Nanoteknologi til kamp mod bakterier, Gymnasielærerdag, Aarhus University, Denmark

Nielsen, Brian Bech, Præmisser og visioner, Didaktikcenter ved Det Naturvidenskabelige Fakultet, Aarhus University, Denmark

Nielsen, Brian Bech, iNANO: Interdisciplinary Nanoscience Center at Aarhus University, Ledelsessekretariatet (1), Aarhus University, Denmark

Nielsen, Brian Bech, iNANO: Interdisciplinary Nanoscience Center at Aarhus University, Ledelsessekretariatet (2), Aarhus University, Denmark

Nielsen, Brian Bech, Nanoelectronics and nanophotonics, iNANO, Interdisciplinary Nanoscience Center at Aarhus University, Denmark

Nielsen, Brian Bech, Nanokrystallernes farverige verden, iNANO, Interdisciplinary Nanoscience Center at Aarhus University, Denmark

Nielsen, Brian Bech, Nanoscience - Nanotechnology at iNANO, iNANO: Interdisciplinary Nanoscience Center at Aarhus University, Rectorate at Aarhus University, Denmark

Nielsen, Brian Bech, Semiconductors - nanocrystal and bulk properties: Substantially different or largely similar? Department of Physics and Astronomy, Aarhus University, Denmark

Nielsen, Brian Bech, The exquisite art of presenting a brilliant talk: A personal view. INASCON, Fuglsøcentret, Knebel, Denmark

Invited talks

Nielsen, Brian Bech, The exquisite art of presenting a brilliant talk: A personal view. Sandbjerg Gods,Faculty of Agricultural Sciences, Aarhus University, Denmark

Nielsen, Niels Christian, Multiple-oscillating field techniques for dipolar recoupling without dipolar truncation, EUROMAR, Saint Petersburg, Russia

Nielsen, Niels Christian, Multiple-oscillating field techniques for dipolar recoupling without dipolar truncation, 49th Experimental NMR Conference (ENC), Pasific Grove, CA, USA

Nielsen, Niels Christian, NanoFOOD - antimicrobial peptides, fibrils, and biological response, Nanotech Northern Europe, Copenhagen, Denmark

Nielsen, Niels Christian, Brug af nanoteknologier i fødevarer og materialer, Landbrugsrådet, Copenhagen, Denmark

Nielsen, Niels Christian, Crash course on the use of SIMPSON for simulation of solid-state NMR spectra, Bruker Biospin, Karlsruhe, Germany

Nielsen, Niels Christian, Design and optimization of solid-state NMR experiments, Harvard University, MA, USA

Nielsen, Niels Christian, Nanotechnology in relation to agriculture and food research, XXII EURAGRI, Agricultural Research for Sustainable Development, Foulum, Denmark

Nielsen, Niels Christian, NMR spectroscopy - an eye to art, Pratt Institute, New York City, NY, USA

Nielsen, Niels Christian, NMR studies of fibrils and membrane proteins, Danish Chemical Society 4th Aarhus Winter Meeting, Aarhus, Denmark

Nielsen, Niels Christian, Novel dipolar recoupling experiments for biological solid-state NMR spectroscopy, Optimal control and multiple-field techniques, Forschungsinstitut für Molekulare Pharmakoloigie (FMP), Berlin, Germany

Nielsen, Niels Christian, Numerical simulations in biological solid-state NMR: SIMPSON, 2nd Advanced Solid-State NMR Training Course, Sandbjerg, Denmark

Nielsen, Niels Christian, Optimal control in solid-state NMR spectroscopy, PRAQSYS 2008, The Principles and Applications of Control in Quantum Systems, Eugene, OR, USA

Nielsen, Niels Christian, Polarization transfer mechanisms for DNP experiments, J. W. Goethe University, Frankfurt, Germany

Nielsen, Niels Christian, Recoupling Tehniques, 2nd Advanced Solid-State NMR Training Course, Sandbjerg, Denmark

Nielsen, Thomas, MRI for radiotherapy professionals, Image-Guided Radiotherapy, Acta Oncologica Symposium, Aarhus, Denmark

Nissen, Poul, Crystal structures of P-type ATPases, Na+,K+-ATPase and retalted transport ATPases of P-type, Aarhus, Denmark

Nissen, Poul, Et røntgenblik på livets molekyler, U-Days, Aarhus University, Denmark

Nissen, Poul, P-type ATPase Pumps, Membrane Transport in Flux: The ambiguous interface between channels and pumps, London, Great Britain

Nissen, Poul, Structure and function of cation pumps, iNANO, Interdisciplinary Nanoscience Center at Aarhus University, Denmark

Nissen, Poul, Structure, Function, and Regulation of P-type ATPase Pumps, Gordon Conference Ligand binding and molecular gating, Ventura, CA, USA

Nygaard, Jens Vinge, Examples from Biomechanics solved by the finite element method using Comsol, Aarhus University, Denmark

Nygaard, Jens Vinge, PhD course in Controlled Release and Drug Delivery - functionalised 3D scaffolds for Tissue Engineering, Department of Biotechnology, Chemistry and Environmental Engineering, Aalborg University, Denmark

Ogilby, Peter Remsen, Optical Experiments with Singlet Oxygen: From Single Cells to Gold Nanodiscs, Symposium on Pharmaceutical Photochemistry, American Society for Photobiology Biennial Meeting, San Francisco, CA, USA

Ogilby, Peter Remsen, Safe sex, dry feet and good beer, Norwegian University of Technology and Science, Trondheim, Norway

Ogilby, Peter Remsen, Singlet Oxygen in Single Cells: Optical Experiments with Sub-Cellular Resolution, Farkas International Symposium on Photochemistry in Organized Media, Ein Gedi, Israel

Ogilby, Peter Remsen, Singlet Oxygen Microscope, University of Milan-Bicocca, Italy

Pedersen, Thomas Garm, Linear and Nonlinear Optical Properties of Carbon Nanotubes, Mathematical aspects of transport in mesoscopic systems, Dublin, Ireland

Ravnsbæk, Dorthe, Nanoteknologi - småt har aldrig været større, Frit oplysningsforbund, Aarhus, Denmark

Revsbech, Niels Peter, Menneskets indvirken på havmiljøet, Folkeuniversitetet, Kattegatcenteret, Grenå, Denmark

Revsbech, Niels Peter, New microsensor technology for study of the OMZ and its organisms, University of Concepcion, Chile

Revsbech, Niels Peter, Stox ultra-low oxygen sensor and cold-tolerant nitrate biosensor. Max-Planck-Institut für Marine Mikrobiologie, Bremen, Germany

Revsbech, Niels Peter, Økologien som forståelsesramme, Folkeuniversitetet, Holstebro, Denmark

Schauser, Leif, NanoFOOD: Udvikling af antibakterielle overflader og sensorer, FoodPharmaTech, Herning, Denmark

Schauser, Leif, Nanoteknologi i marken, Plantekongres, Dansk Landbrugsrådgivning, Landscentret, Herning, Denmark

Shipovskov, Stepan, Homogeneous Esterification By Lipase From B. cepacia in the fluorous biphasic system, Biocatalysis in Non-conventional Media, Moscow, Russia

Shipovskov, Stepan, Non-aqueous biocatalysis, Workshop at Codexis Inc., Singapore

Skibsted, Jørgen Bengaard, Incorporation of Aluminum in the C-S-H phase: Synthetic samples and Portland cements studied by 27Al and 29Si MAS NMR spectroscopy, NANOCEM, Workshop on C-S-H Synthesis, Dijon, France

Skibsted, Jørgen Bengaard, Solid-State MAS NMR Spectroscopy in Inorganic Materials Science: Heterogeneous Catalysts and Portland Cement-Based Materials, University of Edinburgh, Center for Science under Extreme Conditions, University of Edinburgh, Scotland

Sutherland, Duncan, From Nanoscience to Nanotechnology; Utilising the nanoscale. The Annual Meeting of The Danish Society of Pharmacology and Toxicology, Copenhagen, Denmark

Sutherland, Duncan, Nanopatterning proteins over large areas for biological applications, American Vacuum Society 2008, Boston, MA, USA

Sutherland, Duncan, Plasmon Hybridisation at metal nanostructrues as a route to sensitive optical detection, SPIE Plasmonics, San Diego, CA, USA

Sutherland, Duncan, Protein nanopatterns for controlling stem cell function, Nanotech Northern Europe, Copenhagen, Denmark

Sutherland, Duncan, Surface molecular engineering and biosensing, INYS Nanomechanical sensors for biological applications - research tools or the next generation of biosensors?, Copenhagen, Denmark

Sørensen, Jesper, Drug Design (1), Dansk Naturvidenskabsfestival, Denmark

Sørensen, Jesper, Drug Design (2), Dansk Naturvidenskabsfestival, Denmark

Vang, Ronnie Thorbjørn, A Cu/Pt Near Surface Alloy for Water-Gas Shift Catalysis Studied by STM, XPS, TPD, and DFT, 2nd EMPA symposium: Hydrogen and Energy, Braunwald, Switzerland

Vosegaard, Thomas, Complete suppression of mosaic spread, International conference on magnetic resonance in biological systems, San Diego, CA, USA

Vosegaard, Thomas, Fast solid-state NMR techniques for structural studies of antimicrobial peptides, Leibniz-Institut für Molekulare Pharmakologie, Germany

Vosegaard, Thomas, Oriented sample solid-state NMR, Advanced solid-state NMR training course, Sandbjerg, Denmark

Vosegaard, Thomas, Oriented samples - towards the study of large membrane proteins, BIOCONTROL course, Aarhus, Denmark

Vosegaard, Thomas, SIMPSON - applications in biological solid-state NMR, AK Spiess, Usedom, Germany

Vosegaard, Thomas, SIMPSON crash course, Sandbjerg, Denmark

Vosegaard, Thomas, SIMPSON demonstration, Advanced solid-state NMR training course, Sandbjerg, Denmark

Xu, Xuebing, Technology research of lipids and enzymes in fundamental but innovative surroundings, inaugural lecture, Aarhus, Denmark

Xu, Xuebing, Production of Mono- and Diglycerides, 99th AOCS Annual Meeting and Exhibition, American Oil Chemists Society, Seattle, WA, USA

Xu, Xuebing, Process integration for the enzymatic production of biodiesels, 6th Euro Fed Lipid Congress: Oils, Fats and Lipids in the 3rd Millennium: Challenges, Achievements and Perspectives, European Federation of Lipids, Athens, Greece

Xu, Xuebing, Process development for the enzymatic production of biodiesels, International Symposium on Biocatalysis and Biotechnology, Taipei, Taiwan

Xu, Xuebing, Modified food oils by biocatalysts: characteristics and their uses, SMILE, Kuala Lumpur, Malaysia

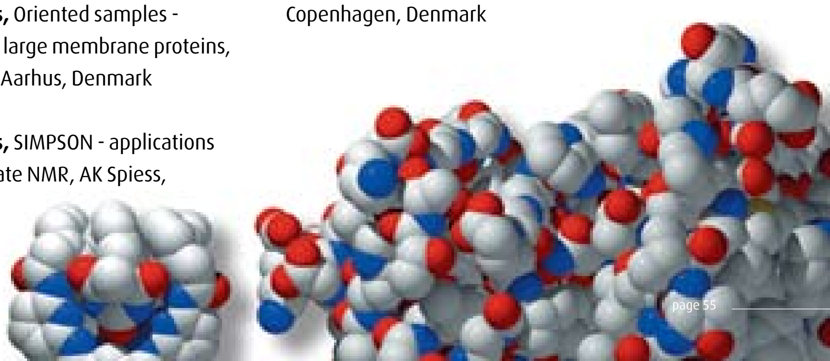
Xu, Xuebing, Modification of Antioxidants for Different Applications, 99th AOCS Annual Meeting and Exhibition, American Oil Chemists Society, Seattle, WA, USA

Xu, Xuebing, Lipids: our resources from nature for advanced manipulation, 40 Years Anniversary Meeting, Aarhus, Denmark

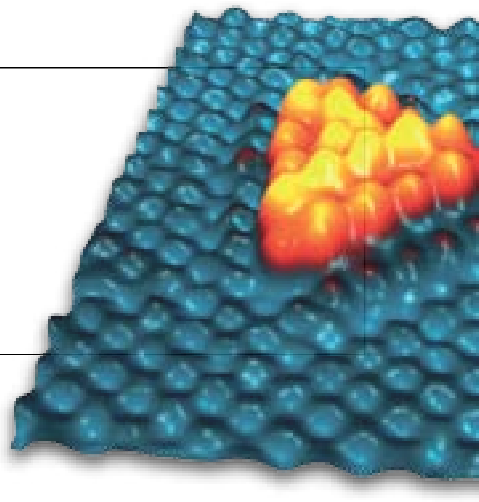
Xu, Xuebing, Lipid ingredients, food physics, and nanoprocessing perceptions, iNANO seminar, Aarhus, Denmark

Xu, Xuebing, Enzymatic tailor-making of lipid ingredients and their physical interactions in food matrixes, Nanotech Northern Europe, Copenhagen, Denmark

Xu, Xuebing, Enzymatic reactions in ionic liquids and characterization by cosmo-rs, EUCHEM, Conference on Molten Salts and Ionic Liquids, Copenhagen, Denmark



Colloquia



iNANO Annual Meeting 2008

January 23, Professor Dr. Klaus Müllen, Max-Planck Institute for Polymer Research Mainz, Germany, "Chemistry for Nanoscience"

January 23, Professor Michael Graetzel, Institute of Chemical Science and Engineering, Faculty of Basic Science, Ecole Polytechnique Federale de Lausanne, Switzerland, "The Magic World of Nanocrystals, From Batteries to Solar Cells"

January 23, Professor Osamu Terasaki, Arrhenius Laboratory, Stockholm University, Sweden, "Mesoporous crystals: Recent progresses in EM structural study"

January 23, Dr. Stacey Harper, Department of Environmental and Molecular Toxicology, Oregon Nanoscience and Microtechnologies Institute, Corvallis, Oregon, USA, "Data integration to support the development of environmentally-benign nanomaterials"

January 23, Professor Dr. Ernst Wagner, Department of Pharmacy, Pharmaceutical Biology – Biotechnology, Ludwig-Maximilians-Universität, Munich, Germany, "Nucleic Acid based Therapeutics as Programmed Nanomedicines"

January 23, Dr. Jeffrey A. Schloss, National Human Genome Research Institute, National Institutes of Health, Department of Health and Human Services, Bethesda, Maryland, USA, "Nanoscience, Nanotechnology, Nanomedicine at the US NIH"

iNANO colloquia, Aarhus

January 4, Associate Professor Xuebing Xu, BioCentrum-DTU, Technical University of Denmark, Lyngby, Denmark, "Lipid ingredients, food physics, and nanoprocessing perceptions"

January 18, Professor Thomas G. Pedersen, Department of Physics and Nanotechnology, Aalborg University, Aalborg, Denmark, "Optical Properties of Nanotubes, -wires and –particles"

February 1, Professor Peter Roepstorff, Danish Biotechnology Instrument Center, DABIC, Department of Biochemistry and Molecular Biology, University of Southern Denmark, "Modification specific proteomics with emphasis on protein phosphorylation and glycosylation"

February 8, Professor Christine McKenzie, Department of Physics and Chemistry, University of Southern Denmark, "2D and 3D assemblies of molecular sensors for oxygen"

February 15, Professor Dr. Junbai Li, Director, Key Lab of Colloid & Surface Science, CAS Institute of Chemistry, Beijing, China, "Nanostructure Transition of Dipeptide for DNA Delivery and Biosynthesis of ATP Driven by Molecular Motors"

February 22, Professor Poul Nissen, iNANO and Department of Molecular Biology, Aarhus University, Denmark, "Structure and function of cation pumps"

February 29, Professor Leif Østergaard, Center of Functionally Integrated Neuroscience (CFIN), Aarhus University and Department of Neuroradiology, Aarhus University Hospital, "iNANO in Neuroscience: Magnetic Resonanance Imaging (MRI), Acute Stroke and Models of Neuronal Viability"

March 7, Dr. Andrei Khlobystov, Carbon Nanomaterials Group, School of Chemistry, University of Nottingham, UK, "Carbon Nano Test-Tubes: Interactions of Nanotubes with Molecules and Colloidal Particles"

March 14, Professor Peter Ogilby, iNANO and Department of Chemistry, Aarhus University, Denmark, "Optical Experiments with Singlet Oxygen: From Single Cells to Gold Nanodiscs"

March 28, Professor Thomas Bjørnholm, director of Nano-science Center, University of Copenhagen, Denmark, "Electron transport through single molecules"

April 4, Professor Martin Kristensen, iNANO and Department of Physics and Astronomy, Aarhus University, Denmark, "Optics on an electronic silicon chip: Nano-structured optical devices"

April 11, Professor Oleg N. Antzutkin, Division of Chemistry, Luleå University of Technology, Sweden, "Structure of Alzheimer's AÐ Fibrils from solid-state NMR, TEM and AFM"

April 25, Dr. Stephen Minger, King's College London, University of London, UK, "Therapeutic and Research Potential of Human Stem Cells"

May 9, Professor George Lisensky, Department of Chemistry, Beloit College, WI, USA, "Resource materials for nanoscale science and technology education"

May 23, Professor Dr. Friedrich C. Simmel, Physics Department, Technical University, Munich, Germany, "From DNA nanotechnology to artificial biochemical networks"

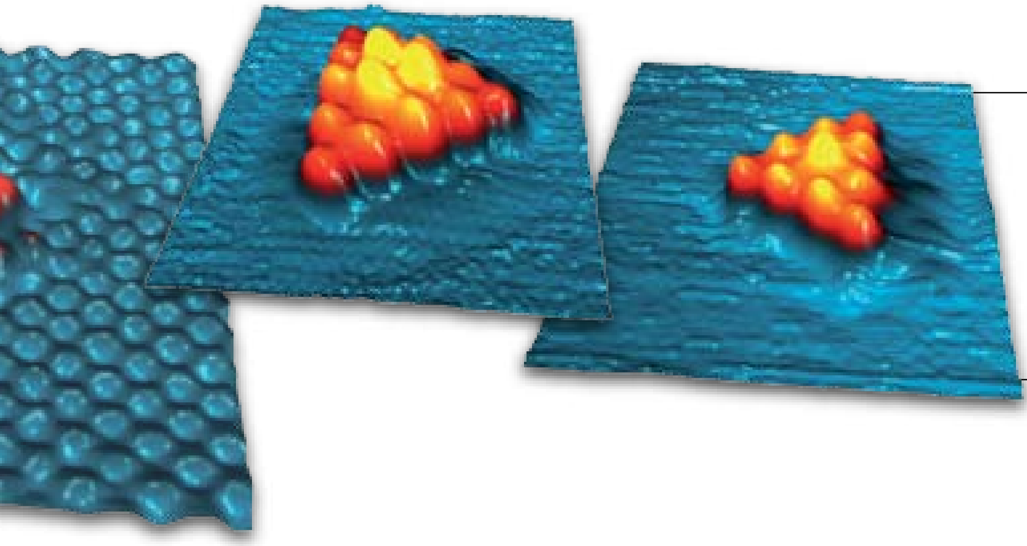
June 19, Professor Allan Hoffman, University of Washington, WA, USA, "Nano-Carriers in Drug Delivery"

August 29, Professor Paul S. Weiss, Distinguished Professor of Chemistry and Physics, Pennsylvania State University, PA, USA, "Designing, Measuring and Controlling Molecular- and Supramolecur-Scale Properties for Molecular Devices"

September 5, Dr. Joseph Wang, Department of Nanoengineering, University of California San Diego, CA, USA, "Multifunctional Nanowires: From Nanomachines to Nanobarcodes"

September 26, Mikhail Kovalchuk, director of Kurchatov Institute, Russia. "Nanotechnology in Russia"

October 3, Professor Enrique Ortega, Department de Física Aplicada, Universidad del País Vasco/ Euskal Herriko Unibertsitatea, Spain, "Electronic



states in metallic nanostructures probed with photo emission"

October 10, Nicholas Turner, Professor of Chemical Biology, Director of Centre of Excellence in Biocatalysis (CoEBio3) Manchester Interdisciplinary Biocentre, Manchester, UK, "Developing novel Biocatalysts via Academic-Industrial Collaborations"

October 17, Francis Quinn, Research director, L'oréal, Paris, France, "The use of nanotechnologies in cosmetics"

November 14, Postdoc Luisa Filipponi, iNANO, Aarhus University, Denmark, "Communicating nanotechnology: Challenges and opportunities"

November 21, Research Director Andre Gourdon, Nanoscience Group CEMES-CNRS, Toulouse, France, "Molecular Devices for Single Molecule STM Experiments"

November 28, Professor Roger Sheldon, Department of Biotechnology, Delft University of Technology, The Netherlands, "Green Chemistry & Catalysis in Organic Synthesis: The Key to Sustainability"

December 5, Professor, director Gabriel Aeppli, London Centre for Nanotechnology, London, UK, "Nanotechnology versus Hospital Superbugs"

December 18, Rector Ove Poulsen, Aarhus School of Engineering, ASE, Denmark, "ASE: Etablering af teknisk videnskabelig forskning i Aarhus"

Specialized iNANO lectures

February 11, Postdoc Billie L. Abrams, Center for Individual Nanoparticle Functionality (CINF), Department of Physics, Technical University of Denmark, "Photocatalysis using Inverse Micelle Synthesized MoS2 Nanoparticles"

February 14, Chang-jun Liu, Key Laboratory of Green Chemical Technology of Ministry of Education, School of Chemical Engineering and Technology, Tianjin University, Tianjin, China, "Preparation of Supported Metal Catalysts Using Argon Glow Discharge Plasmas"

February 26, Professor Dr. Ralf Metzler, Technical University of Munich, Germany, "When Nature goes beyond the central l imit theorem: From gene control to animal oraging"

March 31, Björn Sander and Monika Golas, Department of Cellular Biochemistry, Max-Planck-Institut für biophysikalische Chemie, Göttingen, Germany, "3D Dynamics of Macromolecular Machines Studied by Single-Particle Cryo-EM" & "Structural Insights into Macromolecular Machines Involved in pre-mRNA Processing"

March 31, Jin Zhu, Center for DNA Nanotechnology, iNANO, University of Aarhus, Denmark, "Nano-Scaled Structures: Architecture Control and Functional Applications"

April 2, Postdoc Anpan Han, DTU Nanotech, Department of Micro- and Nanotechnology, Kgs. Lyngby, Denmark "Exploring Proteins using Nanopores"

April 16, Dr. Lisbeth Grøndahl, School of Molecular and Microbial Sciences, The University of Queensland, Australia, "In Vitro Mineralization of Phosphate-Containing Polymers"

April 30, Distinguished Professor and Chair Talat S. Rahman, Department of Physics, University of Central Florida, "Microscopic processes responsible for homo and hetero-epitaxial growth on Cu(111) and Ag(111): Lessons for a self learning kinetic Monte Carlo methods or Factors controlling reactivity of surface oxides and other nanostructures"

May 6, Postdoc Asuka Morizane, Neuronal Survival Unit, Department of Experimental Medical Science, Wallenberg Neuroscience Center, Lund, Sweden, "From bench to bed: Can we generate dopamine neurons from embryonic stem cells for brain repair?"

May 15, Dr. G. Jeffrey Snyder, California Institute of Technology, Pasadena, CA, USA, "Complex Thermoelectric Materials"

August 4, Professor Arto Urtti, Nanotechnology Centre, University of Helsinki, Finland, "DNA delivery and time-resolved fluorescence studies of polyplexes"

August 29, Chen Wang, National Center for Nanoscience and Technology, Beijing, China, "Hierarchical construction of self-assembled two-dimensional molecular architectures observed by using STM"

September 11, Professor Sir Alan Fersht, University of Cambridge, UK, "The Tumour Suppressor p53: Structure, Function-Rescue"

October 3, Professor Enrique Ortega, Department de Física Aplicada I Universidad del País Vasco/Euskal Herriko Unibertsitatea, Spain, "Interplay between electronic states and structures in step lattices and dislocation networks"

October 8, Professor Jianguo Wang, College of Chemical Engineering and Material Science, Zhejiang University of Technology, China, "DFT study of the interactions between metal nanoclusters and CNTs"

October 9, Dr. Bert D. Chandler, Department of Chemistry, Trinity University, San Antonio, TX, USAAu Catalysts: Preparation, Characterization and CO Oxidation Kinetics"

October 16, Dipl.-Phys. Ralf Bechstein, Fachbereich Physik, Universität Osnabrück,

Colloquia

Germany, "NC-AFM imaging of pristine and doped $TiO_2(110)$"

October 18, Professor Robert Madix, Department of Chemistry & Chemical Biology, Harvard University, "Structure Sensitivity of Styrene Epoxidation on Silver"

October 18, Professor Cynthia M. Friend, Department of Chemistry & School of Engineering and Applied Sciences, Harvard University, "Release of Surface atoms as a vehicle for Chemical Reactions"

October 21, Huajie Liu, Centre for DNA Nanotechnology, Department of Chemistry and iNANO, Aarhus University, Denmark, "Studies on proton-driven i-motif DNA nanomachines"

November 6, Dr. Ilko Bald, Free University Berlin, Institute of Chemistry and Biochemistry, Germany,University of Iceland, Department of Chemistry, Science Institute, Iceland, "Site and energy selective bond breaking in biomolecules induced by low-energy electrons and ions"

November 6, Wilhelmine Kudernatsch, Physikalische und Theoretische Chemie, Freie Universität Berlin, Germany, "Interaction of CO, CO_2, and H_2O with Au/Rutile $TiO_2(011)$-(2x1)/Re(10-10) model catalysts"

November 12, Professor Ib Chorkendorff, Center for Individual Nanoparticle Functionality (CINF) NanoDTU, Department of Physics, Technical University of Denmark, "Nanoparticles for Sustainable Energy"

November 13, Professor Dr. Herbert Over, Physical Chemistry Department, Justus Liebig University Giessen, Germany, "Complex Structure-Activity Correlations on Ru-Catalyzed Reactions"

November 18, Adrian Keller, Institute of Ion Beam Physics and Materials Research, Forschungszentrum Dresden-Düsseldorf, Dresden, Germany, "Self-organized nanopatterns by ion erosion"

November 21, Dr. Xavier Bouju, Nanoscience Group CEMES-CNRS, Touluse, France, "Some numerical tools for the simulations of a mole-culemachine on a surface"

November 24, Dr. Achillefs N. Kapanidis, Department of Physics, University of Oxford, UK, "Probing Gene-Transcription Dynamics using Single-Molecule Fluorescence"

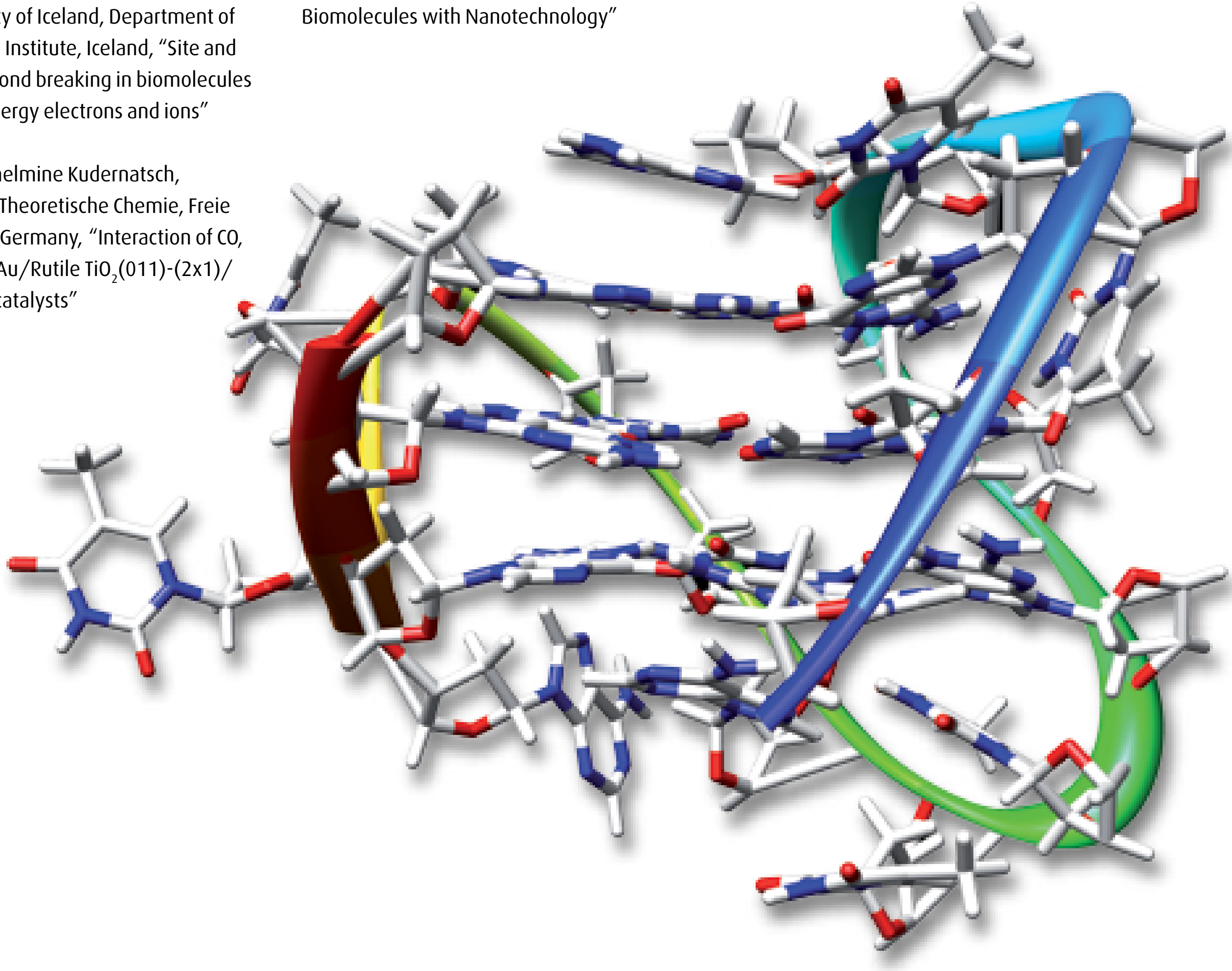
November 24, Professor Vinod Subramaniam, MESA+ Institute for Nanotechnology, University of Twente, The Netherlands, "Manipulating Biomolecules with Nanotechnology"

N**ovember 24,** Ryosuke Ogaki, Laboratory of Biophysics and Surface Analysis School of Pharmacy, The University of Nottingham, UK, "Surface Analysis of Biomedically Relevant Binary Systems by G-SIMS"

November 25, Francisco Ploug, Institute of Catalysis and Petrochemistry, Spanish Research Council Anthony S. Clare, School of Marine Science & Technology, Newcastle University, UK. "Immobilization of enzymes on acrylic carriers functionalized with epoxy groups "

December 4, Associate Professor Lene Oddershede, University of Copenhagen, Denmark, "Single molecule analysis using opti-cal tweezers"

December 5, Dr. Cristina E. Giusca, Research Fellow Advanced Technology Institute, School of Electronics and Physical Sciences, University of Surrey, Guilford, UK, "Scanning Tunnelling Microscopy Studies of Carbon Nanotubes: From Atomic Structure to Density of States"



Staff

Appointments of staff associated with iNANO in 2008

Jeppe Vang Lauritsen was appointed Senior Scientist at Department of Physics and Astronomy

Torben Rene Jensen was appointed Associate Professor at Department of Chemistry

Senior staff

Andreasen, Peter
Baatrup, Erik
Balling, Peter
Besenbacher, Flemming
Birkedal, Henrik
Birkedal, Victoria
Bøttiger, Jørgen
Christensen, Niels Egede
Daasbjerg, Kim
Duch, Mogens
Enghild, Jan Johannes
Fago, Angela
Ferapontova, Elena
Foss, Morten
Gothelf, Kurt Vesterager
Hammer, Bjørk
Hofmann, Philip
Hornekær, Liv
Howard, Ken
Iversen, Bo Brummerstedt
Jakobsen, Hans Jørgen
Jensen, Jan Egebjerg
Jensen, Torben René
Keiding, Søren
Kingshott, Peter
Kjems, Jørgen
Knudsen, Birgitta
Knudsen, Charlotte Rohde
Kristensen, Martin
Larsen, Arne Nylandsted
Lauritsen, Jeppe Vang
Linderoth, Trolle René
Lægsgaard, Erik
Malmendal, Anders
Mamdouh, Wael
Meyer, Rikke L.
Nielsen, Brian Bech
Nielsen, Niels Chr.
Nissen, Poul
Ogilby, Peter Remsen
Olsen, Jeppe
Otzen, Daniel
Pedersen, Finn Skou
Pedersen, Jan Skov
Pedersen, Steen Uttrup
Revsbech, Niels Peter
Schiøtt, Birgit
Skibsted, Jørgen
Skrydstrup, Troels
Sørensen, Esben Skipper
Sørensen, Jens Lykke
Stapelfeldt, Henrik
Stensgaard, Ivan
Sutherland, Duncan
Svaneborg, Carsten
Uyar, Tamer
Vosegaard, Thomas
Xu, Xuebing

iNANO - Interdisciplinary Nanoscience Center

Faculty of Science, Aarhus University

Ny Munkegade 118, Building 1521, DK-8000 Aarhus C, Denmark

www.inano.dk

inano@inano.dk