NINa-News
North German Initiative Nanotechnology SH
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Dear Reader

Schleswig-Holstein's economic strength is well below the national average. Therefore, innovation impulses for the regional economy and new, fast-growing technology-based start-ups are urgently needed to secure the future of the state. The excellent research institutions and universities in Schleswig-Holstein, first and foremost Kiel University as the largest university in the state, are therefore more in demand than ever as impulse providers and innovation drivers for regional economic development. How this can be achieved is shown by successful innovation initiatives such as the BlueHealthTech alliance, which will systematically generate and practically implement innovations at the interface between the sea and medicine in the coming years with federal support of 15 million euros.

In addition to the classic transfer of technology, the transfer of knowledge and social participation in research will also play an increasingly important role in the future. To this end, Kiel University will develop the Seeburg, one of its most beautiful buildings directly at the Kiellinie, into a center for science communication and a showcase for research.

Often, however, the transfer of knowledge and technology is not yet understood and practised as an equal third mission of the universities alongside research and teaching. In order to promote transfer in the long term, Kiel University pooled its resources at the beginning of the year in the newly created Transfer Division under my leadership. Its goal is to transfer more research results than before into innovative services and products in a structured process and thus generate regional value creation and new jobs.

Wir fördern Wirtschaft
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Landesprogramm Wirtschaft: Gefördert durch die Europäische Union - Europäischer Fonds für regionale Entwicklung (EFRE), den Bund und das Land Schleswig-Holstein
Schleswig-Holstein. Der echte Norden.

Axel Koch in front of Kiel's Seeburg, which is being designed by Kiel University as a showcase for science.

A core project is the founding of a university limited liability company, which will considerably simplify co-operations with regional and supra-regional companies from the beginning of next year. In addition, new incentive systems and support services are being planned to increase the number of spin-offs. For example, access to scientific infrastructures, such as large-scale equipment or databases, is to be made considerably easier for spin-offs.

Theme-based transfer networks such as the North German Nanotechnology Initiative SH (NINa SH), in which Kiel University participates with a great deal of commitment, play an extremely important role at the interface between science and industry. The new NINa SH newsletter presents exciting examples of innovative start-ups in the field of nanotechnology. I hope you enjoy reading it!

Axel Koch
Head of the Transfer Division
Kiel University

Quick tests against terror

The start-up herges detection from Kiel wants to make the world safer. To this end, chemists at Kiel University have developed a simple strip test for the rapid detection of explosives on-site.

Explosive devices kill more than 30,000 people worldwide every year, most of them civilians. From everyday life, we know security systems against the danger of explosive attacks mainly from the security checks in airports. For the detection of explosives and drugs, highly specialised and sensitive devices have been developed, which are mainly based on the principle of mass spectroscopy and require intensive training and costly maintenance.

According to an analysis by the Homeland Security Research Corp, however, there is a particular lack of simple and robust detection methods that can be used, for example, by police or customs in the field for routine checks and public events.

As part of a large-scale project at Kiel University, chemists developed a new method that can detect all classes of explosives using a simple colour reaction. The test is sensitive enough to detect quantities between 50 ng and 2 µg.

To further develop the method to market maturity, Professor Rainer Herges of Kiel University and Kiel entrepreneur Dr. Stefan Kloth founded the start-up herges detection. The product hergex-1000 is already commercially available. The test kit consists of only two components: a test stick and the activator. For TATP, the explosive most commonly used by terrorists, it is enough to bring the test stick close to the crystals. If it is an explosive, the colour changes from red to green within a few seconds.

The development of the patented chemistry at Kiel University was made possible by a special research area, which the German Research Society funded for 12 years with 25 million euros.

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Professor Rainer Herges is Director of the Otto-Diels-Institut für Organische Chemie at Kiel University and Head of Development at herges detection.

The simple application of the test enables not only experts from the explosive ordnance disposal service, but also untrained emergency forces to detect explosives at the scene. A further development of the hergex test kit will be available early next year.

The hergex-1000 test kit detects all classes of explosives in seconds and can be used on site without any special on site without any special knowledge.

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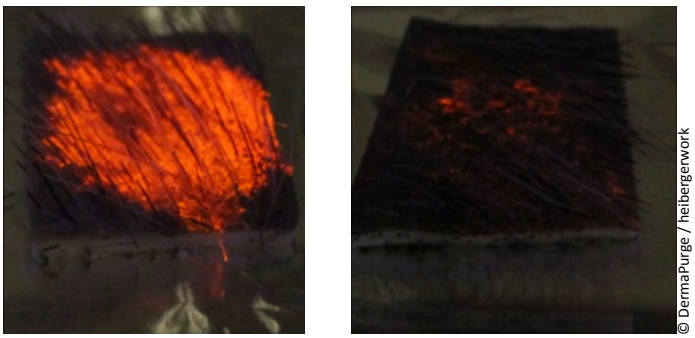
nano-ex: the eye shower for the skin

From laboratory accident to innovation: scientists at the Leibniz Institute of Polymer Research Dresden noticed that up to now available agents remove many nanoparticles from the skin only insufficiently. So they developed the effective solution nano-ex themselves for their colleagues working in nanotechnology.

State-of-the-art infrastructure, regular training and protective equipment in accordance with regulations - workplace safety in nanotechnology activities meets a very high standard in Germany. Nonetheless, accidents can generally never be completely ruled out, which is why there are first aid procedures and corresponding aids such as eye showers, first aid kits and fire extinguishers. However, new technologies also pose new challenges in occupational safety.

Scientists at the Leibniz Institute of Polymer Research Dresden e.V. (IPF) faced such a challenge after an incident in the laboratory: despite the mandatory protective equipment, a student accidentally spilled cadmium selenide quantum dots while working. She contaminated her exposed skin between her lab coat and protective gloves. The student first tried to wash off the particles with soap and water. But under UV light, it became apparent that this measure was ineffective given the amount of particles remaining on her skin. In the aftermath, discussions with experts yielded much advice on how to prevent such incidents. However, measures for effective aftercare were not known.

The concerned scientists at the IPF recognised an occupational safety problem - and the lack of a solution. After testing more than 60 of their own formulations, the team finally found a formula that reliably removed more than 99% of the spilled particles from the skin. And not just for the cadmium selenide nanoparticles that originally triggered the search: the new gel also works on all other types of particles between 4 nm and 3 µm, including metal and metal oxide particles, as well as inorganic and polymeric particles.



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Large quantities of nanoparticles remain on the skin after washing with water (left). The nano-ex cleansing gel from DermaPurge removes the particles much more effectively (right).

There are numerous studies on the question of whether and in what concentration nanoscale particles can penetrate the skin. But the incident at the IPF revealed an aspect essential to occupational safety that is easily overlooked: What happens to the particles that cannot be washed off the skin? In such a case, there is a risk of contamination spreading with all the possible consequential damage, for example through subsequent oral ingestion.

With the proof of effective particle removal from the skin, the added value of the new cleaning gel for occupational safety in nanotechnology was clear to see. Supported by „EXIST“ funding from the Federal Ministry of Education and Research, the highly effective gel has since been further developed into a ready-to-use first aid product.

Since this year, the team at the IPF has already been marketing their innovation nano-ex with their spin-off DermaPurge within the EU, and expansion to the USA and other countries is planned. In future, the first-aid gel should be available in scientific and industrial facilities worldwide - to offer colleagues in nanotechnology the first-aid solution they have been lacking in an emergency.

The gel from DermaPurge is applied to the skin area with a sponge and washed off under running water. The sponge reduces the risk of secondary contamination.

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Maximum power for growing success

Batteries have become an important segment of the automotive market as a result of electromobility. But the demand for energy storage is also growing outside the glamorous mobility sector. The start-up UniverCell from Flintbek near Kiel is aiming to become Europe's leading manufacturer of electrodes and cells for lithium-ion batteries beyond the automotive industry.

UniverCell manufactures customized Li-ion cells.

Not every start-up begins in the garage: the Kiel-based start-up UniverCell began in the children's room. "There were days when all the employees were in my house and we had a family-style lunch," founder Dr Stefan Permien recalls of the early days. In the rooms, the company strategy was defined, the first offers were written and the first small sales were earned. After just under eight months, UniverCell moved into its first offices in Flintbek near Kiel. By the end of the year, a cell factory will be finalized there and already seven-figure sales are being realised. The number of employees is also growing rapidly to a planned 60 people by the end of 2021. "With a focus on all markets excluding automotive, UniverCell is currently Europe's largest lithium-ion electrode and cell manufacturer," Dr Permien sums up.

"There are announcements from competitors, but a lot of imagination is still needed in their manufacturing halls, if they even exist yet. Our manufacturing facilities are up and running and we are in the middle of scaling up." The rapid start was helped by the existing hall in Flintbek, which met the special requirements of cell production, thus establishing the company's location. "Thanks to an excellent supplier network and our in-house expertise in refining the production facilities, we have a head start on potential competitors," says Dr Permien, describing the current production capacity of 1.5 GWh per year.

The chemistry is right: founder Dr Stefan Permien (right) and Marius Strack.

Production is designed for the highest quality and is to be CO2-neutral from 2022. With innovative technology, customised products and organic growth, UniverCell plans to be profitable in two years.

For production in Germany, UniverCell has expertise both in cell chemistry and in electrode design. Through in-house refinement of the production facilities, UniverCell was able to quickly build up a production capacity of 1.5 GWh per year.

Innovative additive microfabrication: ATLANT 3D Nanosystems

From sensors in our smartphones, cars, and computers, to solar cells and countless other applications, our modern world heavily relies on micro- and nano-devices in every aspect of our lives. The Danish deeptech start-up company ATLANT 3D Nanosystems provides a new approach to fabricate such devices by direct atomic layer patterning.

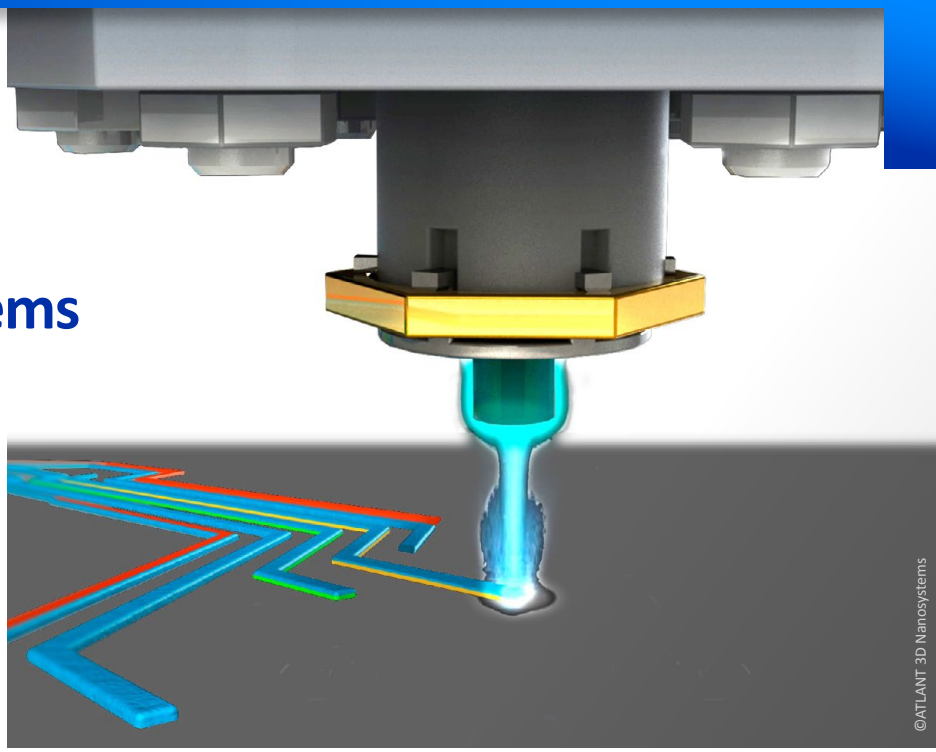

Illustration of the deposition process in action. The line width of the deposited materials is 400 µm in the current system.

Today, the semiconductor industry relies on partly complex and expensive processes like photolithography, sputtering and many more. These established techniques are based on additive or subtractive processes that handle precise and minuscule volumes of materials in the form of thin layers on the surface of silicon or other semiconductor material wafers.

A new approach to fabricating such micro-devices comes in the form of a combination of atomic layer deposition (ALD) and advanced manufacturing, pioneered by the Danish startup company ATLANT 3D Nanosystems. Using this process, it is possible to deposit a desired material, one atomic layer at a time, following a predefined pattern. A very precise stage moves underneath a fixed printhead which dispenses the gases necessary for ALD process. Through repeated passes of the stage, additional atomic layers are deposited, essentially 3D-printing atomic layers of materials such as metals and oxides used in the microfabrication world.

ATLANT 3D Nanosystems has developed this technology and turned it into a product for commercial use: the Nanofabricator. An industrial prototype of this machine was built via the ATOPLOT EU project, a consortium of European companies and R&D organizations. The Nanofabricator can perform depositions of up to 6 different materials, on many different substrate materials up to 4 inches in size.

The ATLANT 3D Nanosystems team is working on developing the technology further still to expand the list of compatible materials, further going down in the line width of the deposited materials, in order to truly put forward microscale advanced manufacturing as the microfabrication technology of the future.

The ATOPLOT machine in the Danish laboratory of ATLANT 3D Nanosystems.

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www.NINa-SH.de
E-Mail: info@nina-sh.de

Prof. Dr. Franz Faupel
Lehrstuhl für Materialverbunde
Institut für Materialwissenschaft
Kaiserstraße 2
24143 Kiel, Germany

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