

NINa-News

North German Initiative
Nanotechnology SH

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Dear Reader,



Dr. Axel Müller-Groeling

the Corona crisis makes us aware of how existentially mankind depends on effective methods to counteract microbiological hazards. Irrespective of the new virus, it has been suspected for some time that the access to clean drinking water will be a potential reason for violent conflicts. The Fraunhofer Institute for Silicon Technology ISIT in Itzehoe (Germany) uses its tech-

nological expertise to deliver relevant solutions for such fundamental challenges. Amongst others we currently develop, together with the company Condias, a miniaturized module for the disinfection of surfaces and the preparation of clean drinking water.

Although the world is currently focused on the virus-crisis, climate change remains a great challenge of mankind with unpredictable future impact. Two key areas for the decrease of climate changing emissions are power generation and storage. Research in these fields is conducted in the state of Schleswig-Holstein on international top-level:

the Helmholtz Centre Geesthacht is already well established in the field of automobile hydrogen technology. It will now be joined by the new Institute for Maritime Energy Systems of the German Aerospace Center (DLR). Stühff GmbH demonstrates how SME in Germany benefit from green nanotechnology in such an innovative setting (see page 3).

Pouch cell manufactured at ISIT.

New battery systems, however, are only useful and sustainable if they can be manufactured on an industrial scale and if the resource cycles can be closed by re-use and recycling. These aspects of energy storage are investigated by Fraunhofer ISIT for a multitude of battery different applications, besides the development of innovative micro- and nanotechnologies (see page 2). We are especially looking forward to welcoming the federal minister of education and research Anja Karliczek and the minister-president of Schleswig-Holstein Daniel Günther at Fraunhofer ISIT. For us, their visit underlines the relevance of our research and development activities.

Mankind currently faces challenges of hitherto unknown scale, on a short term with the spreading new disease and on a medium term with the climate change. New technologies, from Schleswig-Holstein, too, will form the basis for the solutions to these historic challenges. However, at the end of the day, every single one of us is responsible for our collective success due to individual decisions and actions. No technology will ever replace willingness to co-operate, solidarity or humanity. Let us face our responsibility and use the upcoming technologies to shape a future worth living.

Dr. habil. Axel Müller-Groeling
Head of the Fraunhofer Institute for Silicon Technology ISIT

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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.

Disruptive Technologies made in Itzehoe

Novel transistors, innovative batteries and new disruptive materials - the [Fraunhofer Institute for Silicon Technology ISIT](#) in Itzehoe, Germany, develops the technologies for tomorrow's microsystems and power electronics.

Routine measurements should determine the electrical voltage at which thin layers of aluminum-scandium-nitride break down. The involved scientists of Kiel University and Fraunhofer ISIT did not suspect that they will make a [revolutionary finding](#). Which happened when they observed a change in the crystal structure of the material, indicating so-called ferroelectric properties. Axel Müller-Groeling, head of ISIT, is excited, "We just start to identify all the possible new applications in transistors, actuators and many other technological areas. We have to establish manifold co-operations worldwide even just to explore the huge innovation potential of the material."

The ISIT is already member of the unique competence network [Research Fab Microelectronics Germany](#) (FMD) which offers cutting-edge technologies along the whole value chain. Within FMD the ISIT contributes solutions for mega trends, like the development of [LiDAR-Sensors](#) for autonomous driving.

The aim of all development activities at ISIT is a smooth transfer into industrial production. Pilot series can even be manufactured at the institute, if production capabilities are not available otherwise. Besides a multitude of standard clean room processes, ISIT utilizes four innovative technology platforms to realize complex microsystems: piezoelectric aluminum-scandium-nitride, epitaxial poly-silicon, glass flow processes and a [new agglomeration process to integrate microstructures](#) of various materials.

"The integration of three-dimensional structures into microsystems was almost impossible until now," explains Dr. Thomas Lisek, the inventor of the technology. "We realize stable microstructures by agglomerating powders of various materials with a nanometer-thin skeleton. This process provides us totally new degrees of freedom for

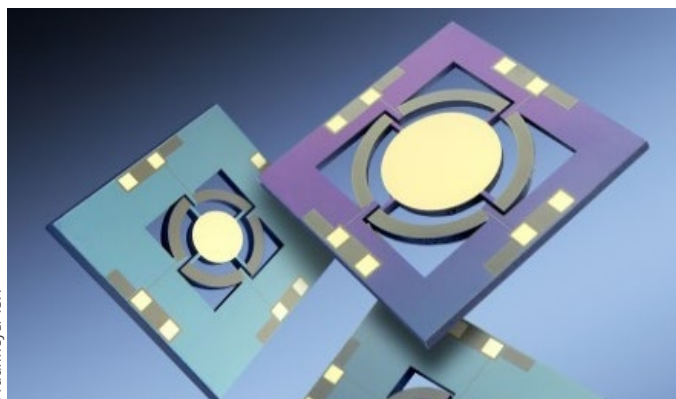


The Fraunhofer ISIT develops and manufactures innovative microsystems in a dedicated clean room area of 1000 m².

a multitude of applications," says Lisek. The technology is already in use for the development of a [DNA-concentrator](#) for a medical quick test and in an [energy harvester](#) which converts vibrational into electrical energy. However, the innovative process can yield solutions for many other applications thanks to the wide choice of materials, the geometrical degrees of freedom and the porous structure of the solids. Microfilters, magnetic drives and sensors as well as thermal insulation for microsystems will be addressed to name but a few.

Dr. Lisek resumes, "Our new technology has disruptive potential for the next generation of microsystems. We are currently establishing co-operations with other research institutes and companies worldwide to realize innovative technical solutions."

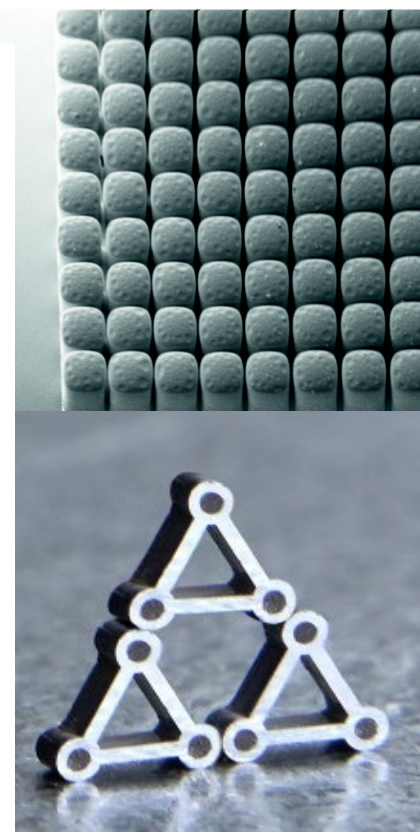
Hightech made in Itzehoe as a driver for innovation - a worldwide export hit.



©Fraunhofer ISIT

ISIT's technology platforms are united in precisely controllable micro mirrors for various applications like LiDAR-Sensors for autonomous driving.

The innovative agglomeration process enables the integration of three-dimensional components into microsystems. Depicted are micromagnets which can be used in sensors and actuators, among others. ISIT is currently the only provider of the technology.



Fossil-free energy thanks to hydrogen technology from Geesthacht

From extended workbench to system manufacturer for a sustainable energy supply based on hydrogen - the company [Stühff GmbH](#) in Geesthacht demonstrates how SME in Germany can utilize green nanotechnology to create jobs and access new markets.

Globalization does not even spare formerly well-working business models of long-standing companies. Thus Holger Stühff, CEO of Stühff GmbH in Geesthacht, had to find an answer to the ever increasing price pressure of the international competition. He managed to differentiate from the competitors by focusing on special materials and respective welding processes. However, Mr. Stühff wanted to establish an own product to become more independent with his company and got in touch with the [Helmholtz-Center Geesthacht](#) (HZG) in 2005. "Back then hydrogen did not enjoy much political tailwind as an alternative green fuel. Things have changed in the meantime since people realized that solely battery-based energy storage will not suffice for the transition to a fossil-free energy supply."

The relevance of Geesthacht as a hub for green hydrogen technology is demonstrated by the upcoming foundation of a new institute for maritime energy systems by the German Aerospace Center (DLR). Mr. Stühff is convinced that valuable synergies will arise in between the new institute and the distinct competencies of the HZG. Currently his company co-operates with the HZG in two projects for the development of [mobile](#) and [stationary](#) hydrogen tanks with nanostructured metal hydrides. Scientists of the HZG around Professor Thomas Klassen recently managed to drastically decrease the loading time of metal hydride hydrogen tanks thanks to [optimized nanocomposites](#).

"Our innovative technology for mobile hydrogen storage differs fundamentally from other current approaches. I believe the system to be very promising," says Stühff. Vehicles achieve a range of 500 km with the new hydrogen system at refueling times of only a few minutes.

Even closer to the market entry are stationary hydrogen installations. "It is about time to take the next step. The system should be used to demonstrate the permanent sustainable energy supply of a community by a combination of wind energy and hydrogen storage." The developed system can balance fluctuations of green power supplies with a storage capacity of 50 kg hydrogen and a fuel cell with 70 % efficiency.



The Stühff GmbH possesses extensive experience in the realization of complex systems for various industries. (© Stühff GmbH)

"A consortium combining operators of wind energy plants, utilities and our hydrogen system should be formed with political support in order to gain operating experience under realistic conditions. The time has come for the metal hydride technology of the HZG to enter the market," believes Stühff. In this case his company will have found its own product with the integration of complete systems for the generation, storage and usage of green hydrogen.

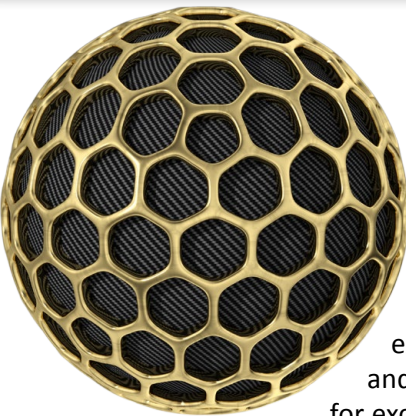
For the green energy transformation the state of Schleswig-Holstein does not only provide the wind but also the necessary high-end technologies.



NINa in times of Covid-19

Nano Meets Medicine | NINa SH general meeting | NIBS 2020

Like many others, NINa SH have to shift their events due to the Corona crisis. A summary of the major changes.

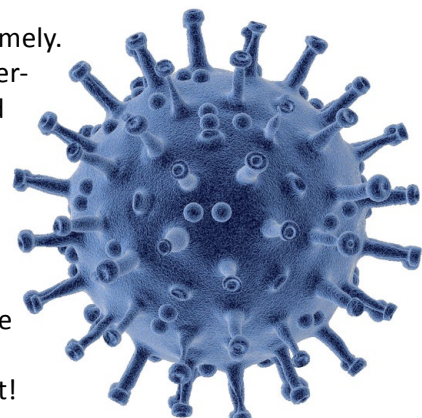


The focused meeting Nano Meets Medicine offers experts from nanotechnology and medicine the opportunity for exchange and initiation of medical innovations. The focused meeting is organized by the institute of medical engineering of Lübeck University, NINa SH and Life Science Nord. The focused meeting, together with NINa SH's general meeting, could not take place as scheduled in March. Both events will be held later this year and NINa SH will in-

form about the new dates timely.

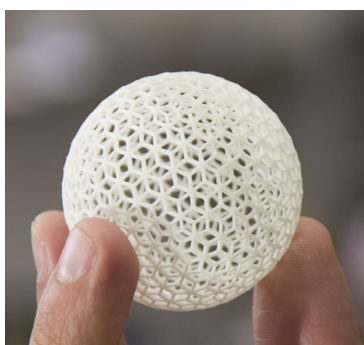
The international conference Nanotechnology and Innovation in the Baltic Sea Region (NIBS) 2020, which was planned in the city of Hamburg in June, unfortunately has to be canceled. The next NIBS conference will take place in 2021.

Until then stay well and fit!



NINa's Highlights

On this page, NINa SH presents recent highlights from the field of nanotechnology and news from science and industry. You can inform the network about your activities here, too. [Send your highlight to info@nina-sh.de](mailto:info@nina-sh.de).

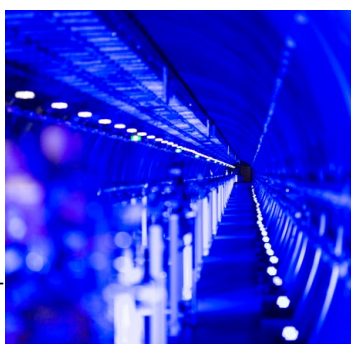


Additive manufacturing in medical engineering

9. - 11. September 2020 | conference | Lübeck, Germany

3D printing yields enormous advantages for medical technology like prostheses or matrices for tissue engineering. The second international conference Additive Manufacturing Meets Medicine is a hub for engineers, scien-

tists, technicians, practitioners and entrepreneurs who are involved in 3D printing in medical applications. Further information are provided on the [website of the conference www.ammm.science](http://www.ammm.science)



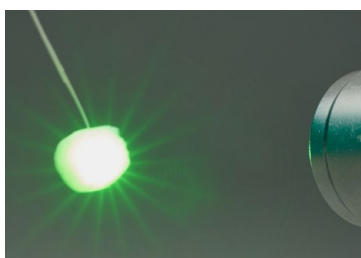
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Save-the-date: nano imaging workshop at European XFEL

10. September 2020 | workshop | Hamburg, European XFEL

The workshop aims at linking the topics "nano" and "imaging" for users of x-ray based in the fields of medicine, industry and science. The workshops offers participants the opportunity to communicate latest trends and scien-

tific results as well as to network with experts on x-ray based imaging techniques. The workshop is organized jointly by [European XFEL](http://www.xfel.eu), NINa SH, [Initiative Bildverarbeitung e.V.](http://www.bildverarbeitung.de) and [WTSH GmbH](http://www.wtsh.de).



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Aero-material made of 99,99% air for laser illumination

Although lasers are highly efficient light sources they are usually not suitable for illumination applications due to the highly directed light output. Scientist around Professor Rainer Adelung from Kiel University now [report in Nature Communi-](https://doi.org/10.1038/s41586-020-2000-0)

[cations](https://doi.org/10.1038/s41586-020-2000-0) on nanostructured aero-boronitride which strongly scatters light due to its extremely porous structure. The researchers are now looking for partners from industry to integrate the new material in illumination systems.

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