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Innovative Technologies / New Applications

FUTURE TECHNOLOGIES

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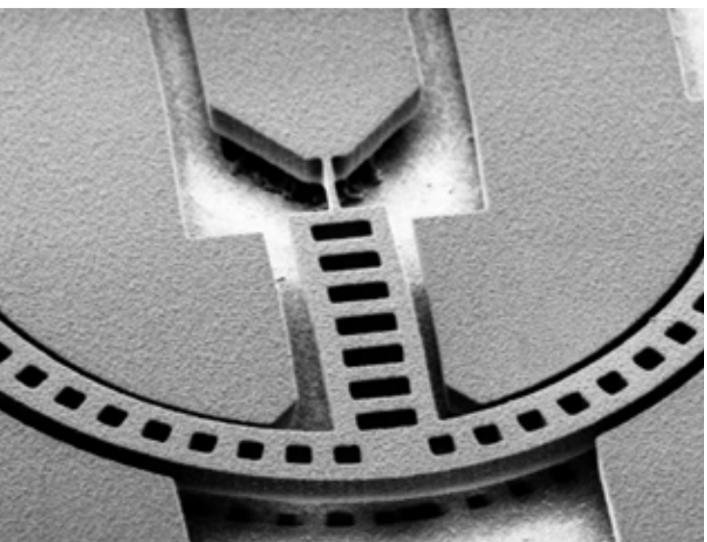

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As I write this final editorial as CEO of IVAM, I am filled with gratitude and reflection. As I retire at the end of this month, I want to thank our loyal readers and dedicated authors from our member network. Your support and enthusiasm have driven our success.

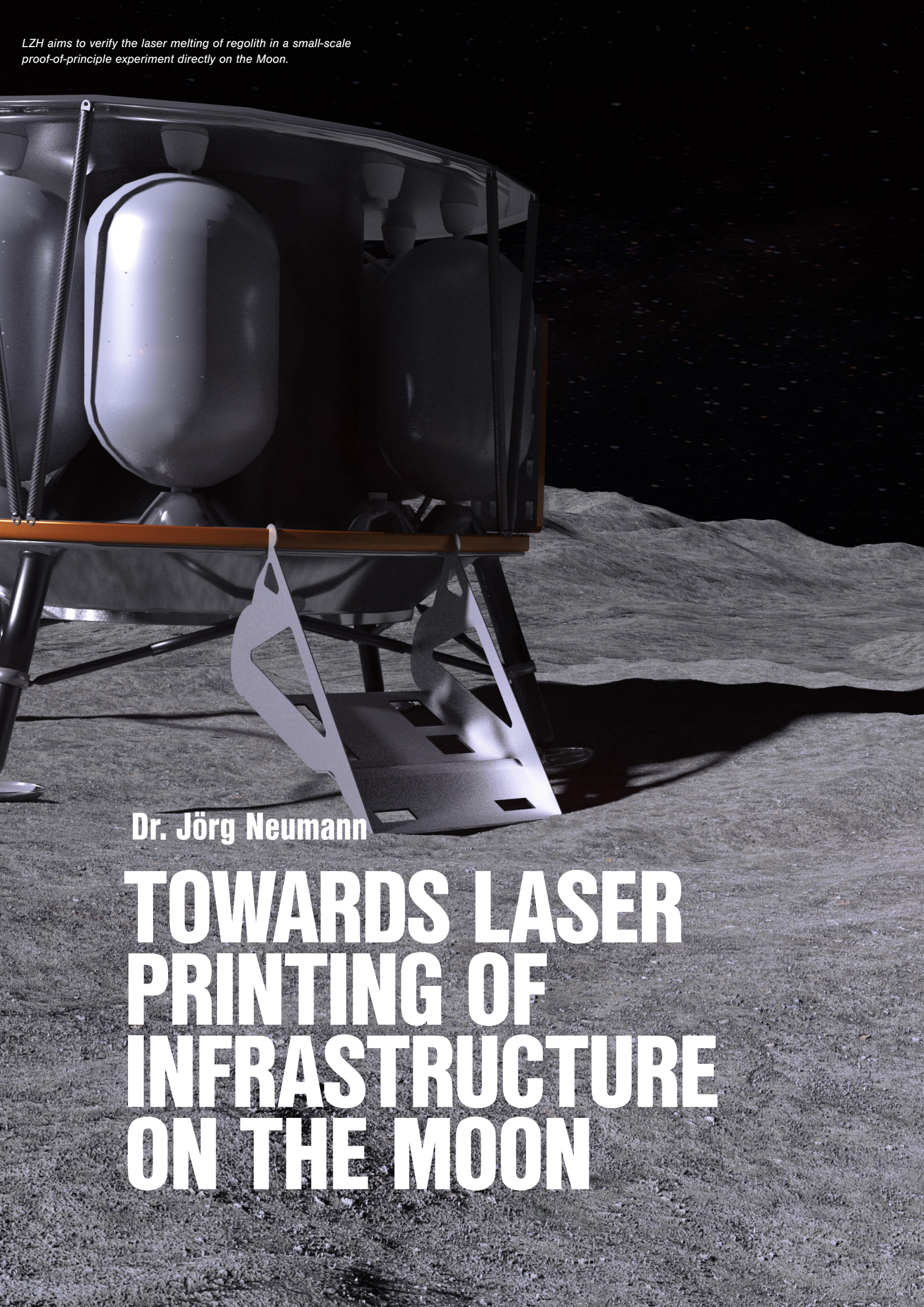
This edition, themed “Forward Horizons: Exploring Future Technologies,” highlights transformative innovations that will reshape our world. We begin with cutting-edge upcycling techniques and explore laser printing on the moon. This groundbreaking technology could make lunar bases a reality, showcasing the synergy between innovation and human ingenuity in space exploration. We also delve into edge computing with NEM Switch Technology, a key player in the next computing revolution and innovative on-board charging in electric vehicles.

Our issue covers innovations as well from this years’ IVAM Hightech Summit, where we discussed how science fiction visions have seamlessly transitioned into tangible technological advancements.

As I say goodbye, I am filled with optimism for the future. I am grateful for the opportunity to have always been at the cutting edge of technology and to see the most fascinating breakthroughs.

Warmest regards,

Thomas Dietrich



LZH aims to verify the laser melting of regolith in a small-scale proof-of-principle experiment directly on the Moon.

Dr. Jörg Neumann

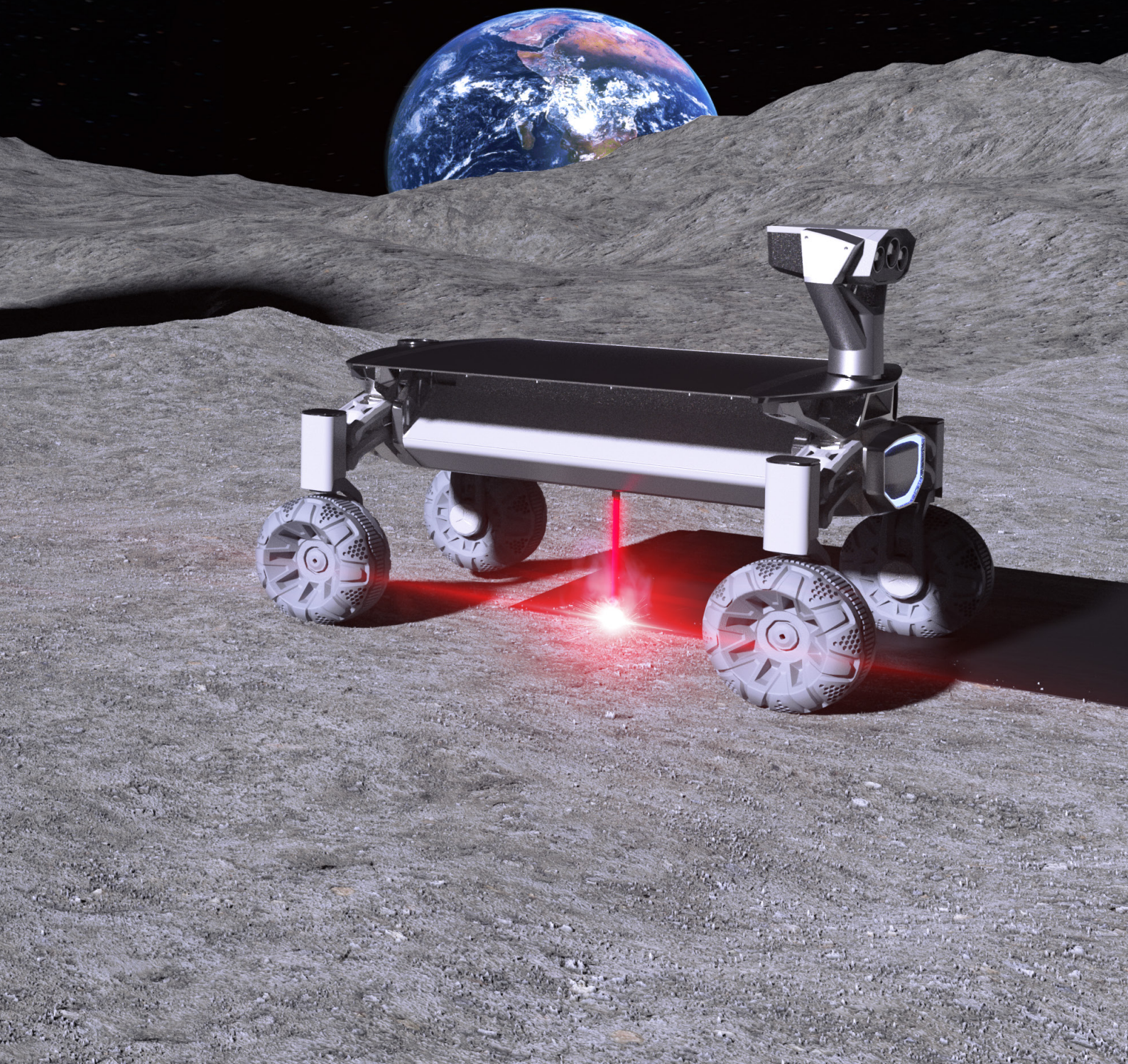
TOWARDS LASER PRINTING OF INFRASTRUCTURE ON THE MOON

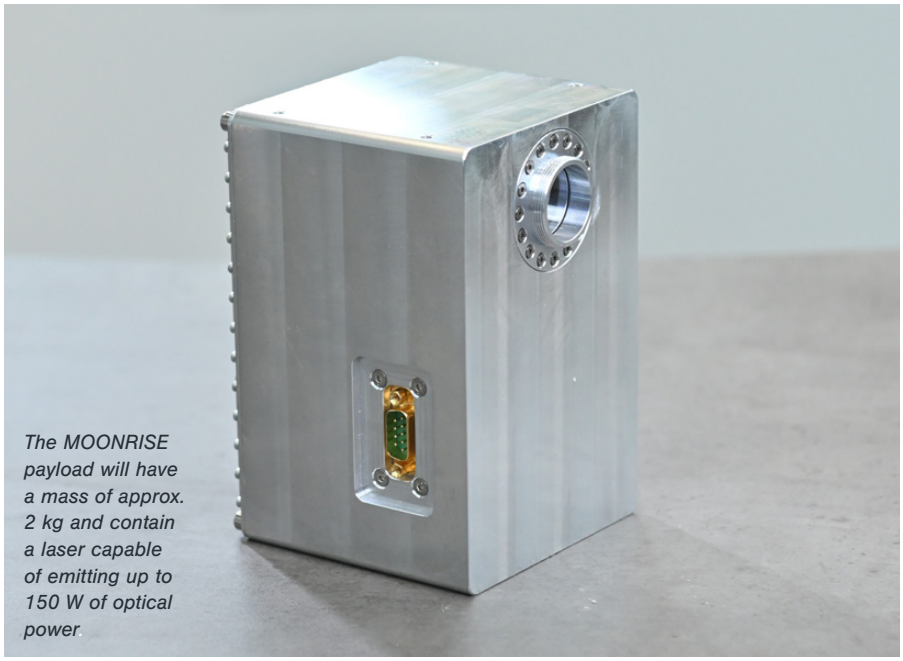
The Moon: highest demand in space research

All major space agencies currently plan to establish a permanent crewed presence on the Moon in the next decades, which could serve for further scientific investigations on its geology and origin. The Moon is also an ideal location for scientific instrumentation such as radio or optical telescopes or even gravitational wave detectors, which will be decoupled from terrestrial influences or profit from the absence of atmosphere or tectonics. Moreover, a crewed lunar station could help to learn for self-sustaining long-term stays in space environments, before going to much more distant planets like Mars. The Moon is an excellent starting point for further planetary exploration since compared to Earth less gravitational potential needs to be overcome for interplanetary travel, which saves a significant amount of rocket fuel. Finally, stays on the Moon might become a tourist attraction in the future.

Saving Transportation Costs by In-Situ Resource Utilization (ISRU)

However, high transportation costs from Earth to the lunar surface of currently about one million dollars per kg inhibit bringing major construction





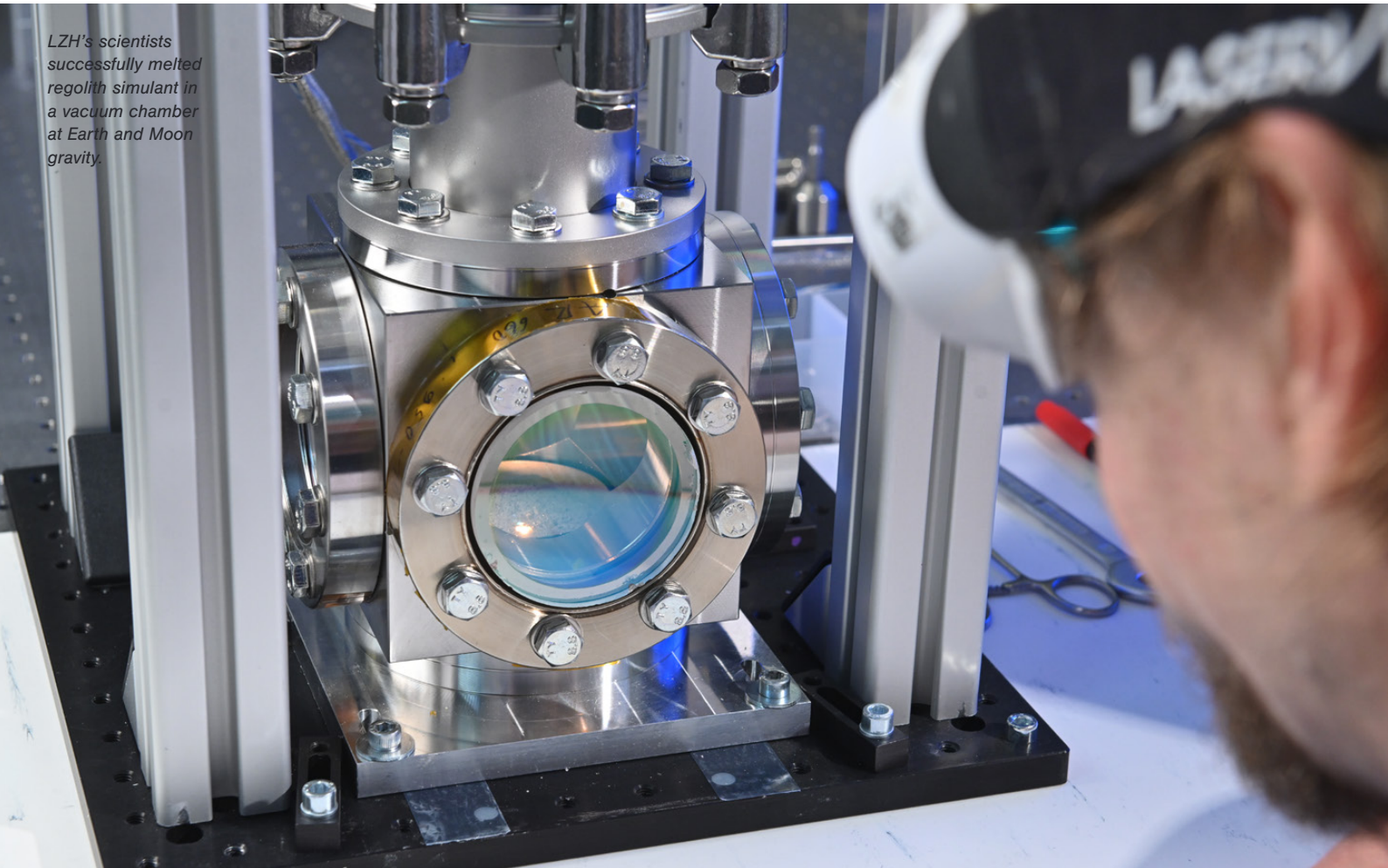
The MOONRISE payload will have a mass of approx. 2 kg and contain a laser capable of emitting up to 150 W of optical power

elements to the Moon, needed for landing and launch pads, astronauts' shelters against ionizing radiation, or paved transportation roads. Instead, space research pursues in-situ resource utilization (ISRU) and the use of as much as possible of the already existing material on the Moon. The Moon is covered with a thick layer of fine pulverized rocks, so-called regolith. When using this lunar dust for construction, it must be solidified - ideally without any additive to be brought from Earth at high transportation costs.

Currently, there are several technologies under consideration, which are based on regolith heating and melting for solidification. Regolith can be heated by microwaves, which requires complex regolith handling systems, or be melted directly on the lunar surface by concentrated sunlight using a simple Fresnel lens. However, to obtain more precise processing and also for operation in shadowed areas, a laser can be used for regolith melting, which was after a trade-off in our view the most promising technology.

Project MOONRISE: Laser Melting of Regolith

To establish this technology, the Laser Zentrum Hannover e.V. (LZH) and the Technical University Berlin teamed up to investigate the process of laser melting of regolith for infrastructure construction. We used different types of artificial lunar regolith (regolith simulants) according to other sites on the Moon for our laser melting experiments. These simulants can be manufactured



LZH's scientists successfully melted regolith simulant in a vacuum chamber at Earth and Moon gravity.

In experiments, LZH's scientists created small beads, lines and areas (0D-, 1D- and 2D-structures) by laser melting.

from specially processed minerals available on Earth such as basalt or anorthosite. In our experiments, we created small beads, lines, and areas (0D-, 1D- and 2D-structures) by laser melting. However, the conditions on Earth cannot fully emulate the lunar environment. Whereas vacuum and temperature conditions can be established in a processing chamber on Earth, other conditions such as lower gravitation on the Moon (0.16 g) can only partly be created, e.g. for a short period in an active drop tower with adjustable acceleration like the Einstein Elevator in Hanover. Moreover, simulants might not be fully representative of the lunar regolith.

After extensive investigation of the laser melting process of regolith simulants on Earth in vacuum and under Moon gravity in the Einstein Elevator, we aim to verify the melting process in a small-scale proof-of-principle experiment directly on the Moon. We have already built a rugged engineering model of our laser-based payload called MOONRISE, which was already tested against the demanding environmental conditions on a lunar lander.

Next Steps: Flight Model and AI Training for flight to the Moon in 2026

Just recently we contracted the US-based commercial lunar transport company Astrobotic for bringing our payload to the lunar surface by the end of 2026. In parallel, we started the flight model development of our MOONRISE payload. Our payload will have a mass of approx. 2 kg, contain a laser capable of emitting up to 150 W of optical power, and be able to melt small 0D, 1D and 2D structures directly on the lunar surface. Since the melted structures remain on the lunar surface, the quality of the written structures can only be assessed by camera images. To enhance this evaluation, we are currently developing an artificial intelligence-based quality assessment framework for these images.
After verifying the laser melting process on the Moon, we plan to scale our process to bigger structures as well as to implement autonomous operation.

Laser Zentrum Hannover e.V., Hanover, DE
https://www.lzh.de/en/moonrise

In The MOONRISE project is currently funded by Space Agency of the German Aerospace Center (DLR) with federal funds of the Federal Ministry for Economic Affairs and Climate Action in accordance with a parliamentary resolution of the German Bundestag and was previously funded by the VolkswagenStiftung as well as by the European Space Agency.

Dr. Federica Haupt

NEW FRONTIERS OF EDGE COMPUTING WITH NEM SWITCH TECHNOLOGY

Edge computing is one of the emerging concepts in the industrial Internet of Things (IIoT). The idea of processing data not in a remote data centre, but directly where the data are collected has huge advantages in terms of efficiency, data security and energy consumption. However, several industrial applications involve operating conditions that are very challenging if not impossible for technologies based on standard CMOS transistors – such as high temperatures or high radiation levels. Nanoelectromechanical (NEM) Switch Technology can push the domain of IIoT to these harsh environments by enabling digital components and memory cells able to operate at temperatures as high as 300 °C and radiation levels up to 1 Mrad.

What is NEM Switch Technology?

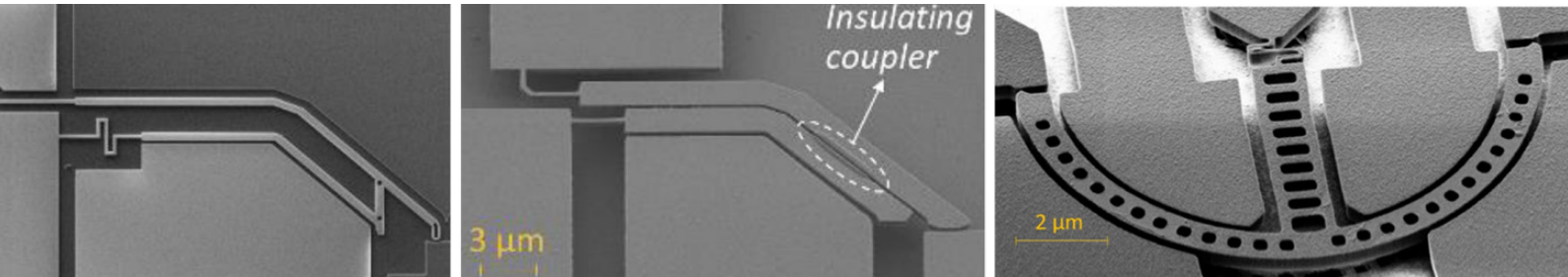
Nanoelectromechanical (NEM) switches are nanoscale silicon relays fabricated using standard semiconductor wafer processing techniques. They can be employed as digital switches to switch on and off the current between a source and drain electrode with a control signal applied to a gate, representing the nanomechanical equivalent of the transistor. NEM switches offer, however, a richer set of functionalities than conventional transistors, allowing for flexibility in circuit and system architectures to reduce device counts and to implement single-chip solutions that includes logic and non-volatile memory.

Three-terminal NEM switches can be used in lieu of transistors to build digital logic circuits in the "complementary" style that is the mainstay of CMOS technology. Four- and seven-terminal relays enable more efficient architectures. For example, a 2-to-1 multiplexer (MUX) circuit can be realized with just two four-terminal relays instead of the 12 transistors required in a complementary CMOS implementation. The seven-terminal relay is a bidirectional, reprogrammable switch that enables the integration on the same chip of logic and non-volatile memory using the same process – which is not possible with conventional CMOS.

Furthermore, NEM switches can withstand much higher temperatures and radiation levels

> **"Edge computing is one of the emerging concepts in the industrial Internet of Things."**

Fig. 1: Different NEM switches designs developed at the University of Bristol. From left to right: 3-terminal, 4-terminal and 7-terminal relays.



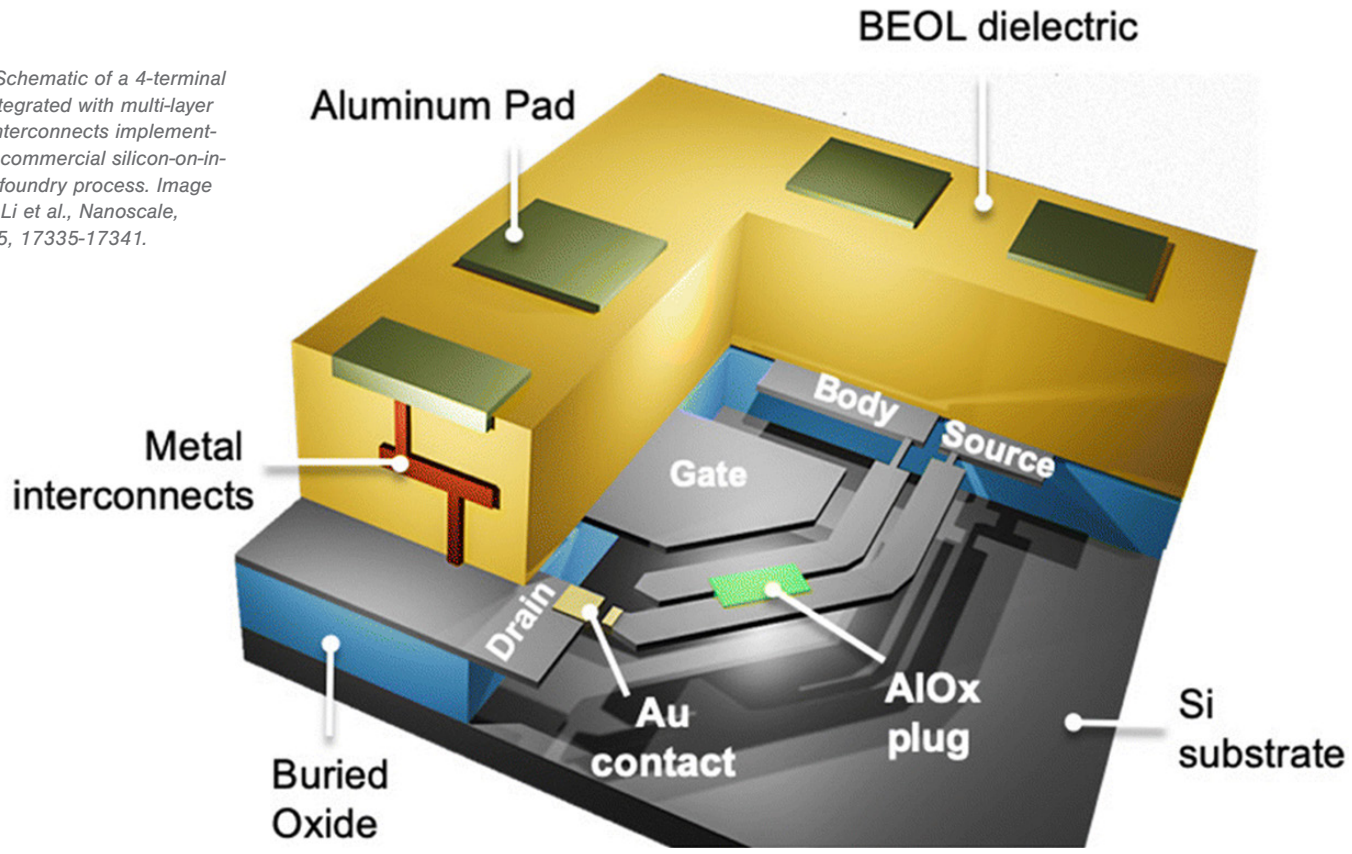


Fig. 2: Schematic of a 4-terminal relay integrated with multi-layer metal interconnects implemented in a commercial silicon-on-insulator foundry process. Image from Y. Li et al., Nanoscale, 2023,15, 17335-17341.

than conventional transistors (up to 300 °C and 1 Mrad), and the presence of an open-air gap in the off state means that the standby power is zero. All these characteristics make NEM Switch Technology an ideal platform for realizing edge-computing systems for harsh environments, such as, for example, wireless devices for monitoring processes inside industrial ovens or calibration memories for sensors in aerospace.

i-EDGE & ZeroAMP

The technology platform for NEM switches is being developed in the project i-EDGE, an initiative co-funded by the EU, UK and Switzerland, which brings together AMO GmbH, Microchip Technology Inc., the University of Bristol, KTH Royal Institute of Technology, the Technical University of Vienna, the Swiss Centre for Electronics and Microtechnology SA, and SCIPROM Sàrl. i-EDGE builds on the baseline technology developed in another project, ZeroAMP, which demonstrated the functionality of all key elements of NEM Switch Technology. The goal of i-EDGE is to bring NEM Switch Technology to TRL 5, moving from demonstrators with few tens of switches to complex systems with thousands of elements. This will requires a substantial downsizing of the NEM switches, from micro- to nanoscale. A foundry-compatible process flow for NEM switches with critical dimensions of 300 nm has already been demonstrated in the ZeroAMP project (see Fig. 2) and is being further developed in i-EDGE.

A foundry-compatible fabrication flow

An important asset of NEM Switch Technology is that it is fully compatible with standard silicon manufacturing. Large-scale integrated circuit based on NEM relays can be realized using conventional foundry platforms, either entirely within the foundry process or as a back-end-of-line (BEOL) step. This not only reduces costs for the fabrication of prototypes and proof-of-principle demonstrators, but also provides a clear path for moving from lab-scale device fabrication to the commercial production of competitive products based on NEM Switch Technology.
The ultimate ambition of the i-EDGE project is to commercialize NEM Switch Technology. As part of this vision, the project is also developing a full set of CAD tools, firmware and software to facilitate the broad usage of NEM Switch Technology by application engineers, as well as it is investigating solutions for co-integrating logic and memory based on NEM switches together with sensors and analog elements for wireless charging and data transmission.

Potential applications

NEM Switch Technology is an ideal platform for developing condition monitoring, data logging and calibration systems for harsh environments, which are key requirements in many industrial processes. As proof of principle demonstrator, i-EDGE will develop a wireless token to monitor the temperature in manufacturing ovens. NEM switches are very radiation hard, there are likely to be applications for monitoring sensors to reduce maintenance in the nuclear power industry.

AMO GmbH

www.amo.de
www.zeroamp.eu
www.i-edge-project.eu

PA12 filament for FDM printing, base: 100 % PA12 waste powder, upcycling by CA.

Annerose Hüttl / Christoph Thieroff

OLD TO NEW

UTILIZING UPCYCLING TECHNIQUES TO ENHANCE THE INDUSTRIAL SUITABILITY OF RECYCLED PLASTICS

The KUZ functions as an independent, industry-oriented research, technology, testing, and training center. Operating as a facility dedicated to industrial plastics technology, our research and development activities are concentrated on devising intricate solutions across the entirety of the process and value chain for plastic-based products. Starting with material preparation utilizing twin-screw extrusion, progressing through toolmaking and specialized machine fabrication, injection molding, and extrusion processes, culminating in comprehensive testing and characterization within our accredited laboratory facilities. Within the company's "processing" department, the compounding team is dedicated to optimizing the properties and subsequent application of commercial (bio-)plastics. This is achieved through the strategic incorporation of appropriate additives, exploration of alternative bio-based materials, and the implementation of methodologies for recycling and upcycling post-consumer and post-industrial plastic

waste streams. In the subsequent sections, we present excerpts from ongoing research endeavors focusing on the up-cycling of two distinct materials: PA12 waste powder derived from selective laser sintering (SLS), and post-consumer PET.

The upcycling process of PA12 waste powder

The upcycling process of PA12 waste powder involves addressing the chemical aging of PA12 induced by thermal stress during Selective Laser Sintering (SLS) operations conducted at 170°C for 24 hours. This aging process entails post-condensation reactions, resulting in a notable increase in molecular weight and subsequent reduction in sintering and printing capability. Consequently, reutilization of the spent powder in SLS printing poses significant risks. The assessment of chemical aging is ideally performed utilizing solution viscometry (SV) employing 98% H_2SO_4 as the solvent. In this case, SV enables the indirect determination of PA12 molecular weight. In the context of PA12 upcycling, carboxylic acids (CA; chain scissors), are primarily used for PA12 upcycling, which leads to acid-catalyzed hydrolysis of the polymer, consequently reducing the molecular weight to the desired level. The defined addition of CA results in a nearly pristine material state concerning molecular weight, viscosity, and mechanical properties, as illustrated in Figure 1 (depicting the reduction of Mw from 29.000 to 23.000 g/mol) and Figure 2 (stress-strain behavior, impact strength ak).

The PA12 granulate manufactured via a ZE25Ax47D co-rotating twin-screw extruder and EWA10 underwater pelletizer serves as the raw material for extruding fused deposition modeling (FDM) filament, thereby facilitating the conversion of PA12 waste powder into filament. The resulting filament, with a diameter of approximately 1.75 ± 0.1 mm (as depicted in cover picture), is produced utilizing a micro-extruder (KUZ development), exhibiting commendable roundness and surface quality. Comprehensive testing validates its suitability for component and prototype fabrication through FDM printing techniques.

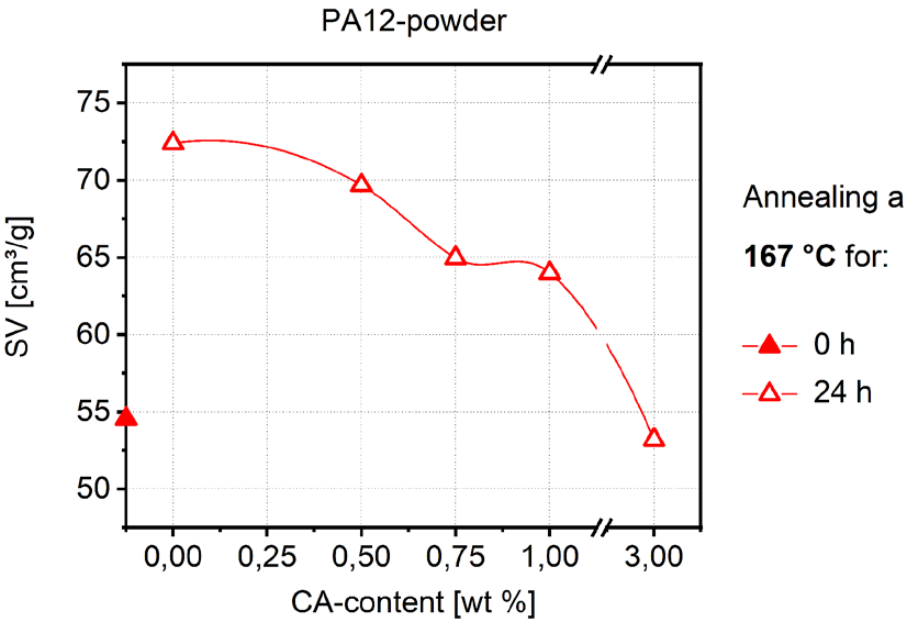


Fig. 1: Solution viscosity of PA12 powder (appr. 170 °C at 24 h) as a function of the CA content.

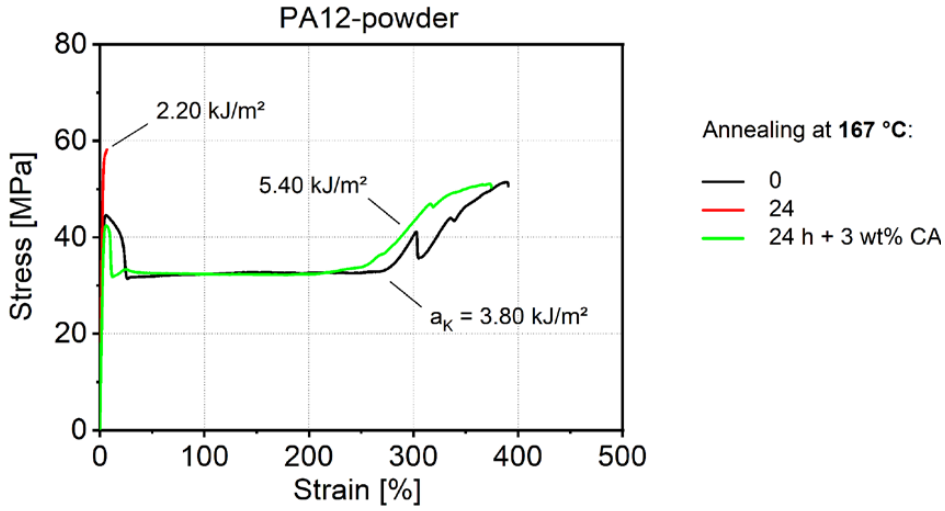


Fig. 2: Stress-strain diagrams for PA12 powder (injection-molded test specimens), previously annealed at 167 °C for 0 h (reference) and 24 h (here without and with CA).

The upcycling process of post-consumer PET

The upcycling process of post-consumer PET involves the utilization

> **“Optimizing the properties and subsequent application of commercial (bio-) plastics.”**

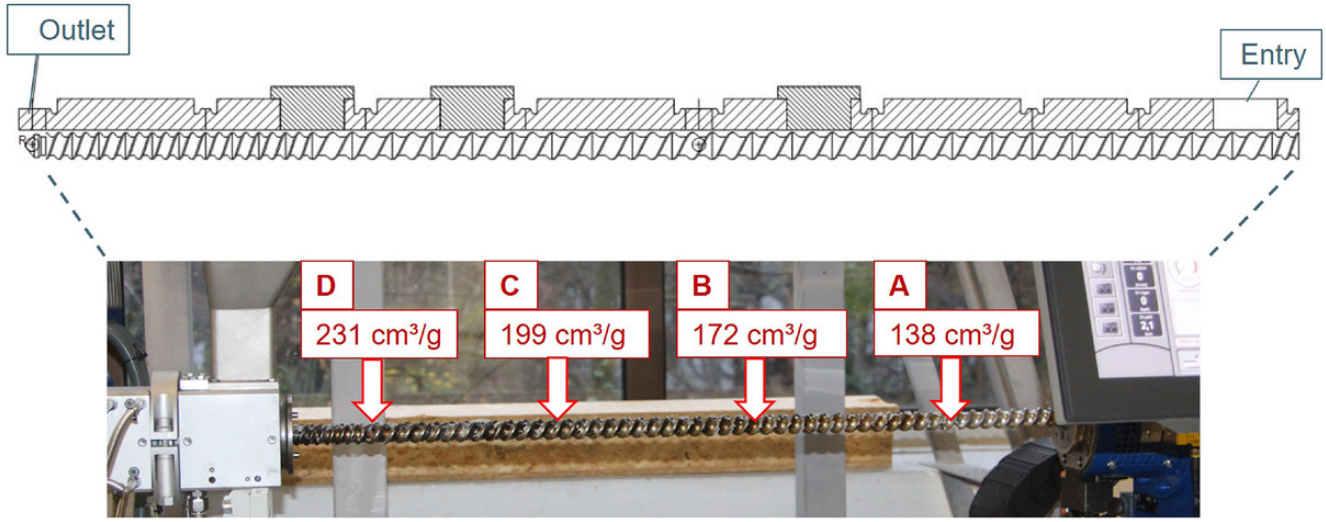


Fig. 3: ZE25Ax47D with screw pair removed, sample collection at 9.5, 19, 28.5, and 38D.

of waste derived from various sources such as films, thermoformed trays, blister packs, and chip cards. These products are fed into the recycling system by consumers and subsequently processed on an industrial scale. During this processing, thermomechanical and hydrolytic degradation reactions occur, often due to multiple processing and the presence of water, resulting in a significant reduction in the rheological and mechanical properties of the recycled PET (rPET). Consequently, rPET cannot be reintegrated into the production process without constraints. To render rPET suitable for injection molding and the fabrication of high-value products, its properties must be aligned with those of virgin PET. The upcycling of rPET can be achieved through the deliberate addition of a chain extender, such as Scona TPPET 4214 PA manufactured by BYK (an epoxy compound), as demonstrated by studies conducted by the KUZ. Through reactive compounding by co-rotating twin-screw extruders, the molecular weight of the polymer chain is significantly increased (Fig. 3), leading to increased melt viscosity and enhanced mechanical properties. essibility. Figure 4 illustrates the favorable impact of reactive compounding on the intrinsic viscosity (IV) and impact strength of the PET compound. The resulting material exhibits properties on par with or exceeding those of virgin PET.

Kunststoff-Zentrum in Leipzig gGmbH
www.kuz-leipzig.de

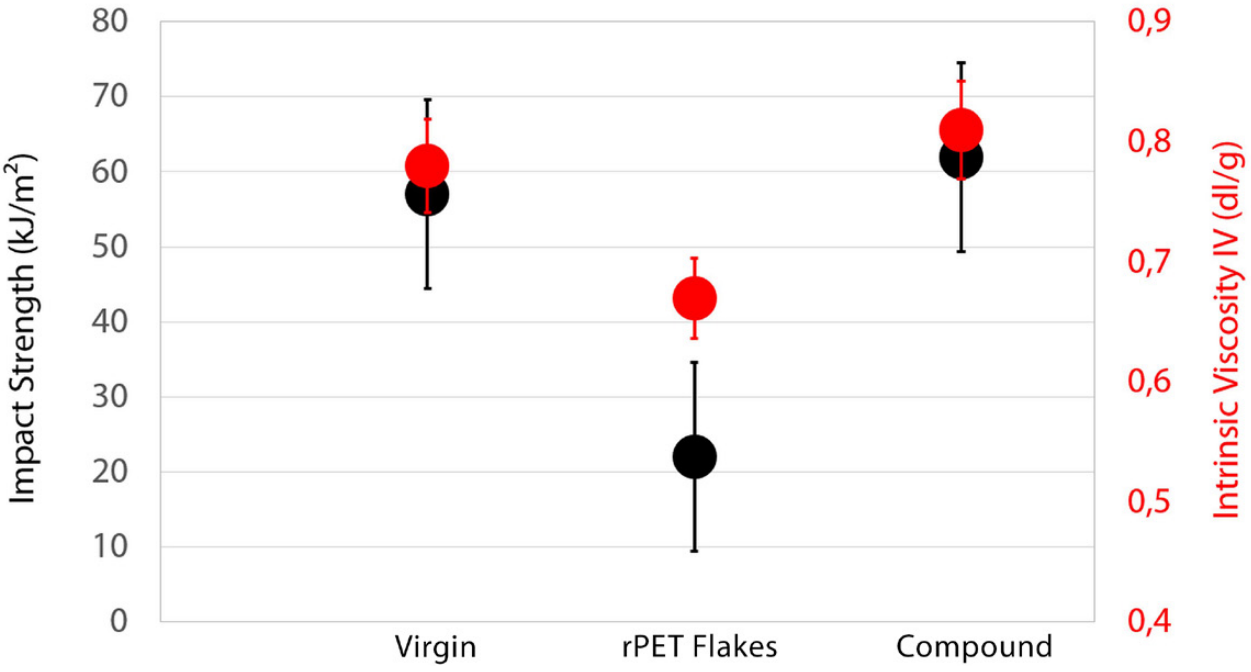


Fig. 4: Impact strength and IV value for virgin PET and rPET without (center) and with chain extender (right: compound).

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Dr. Jana Schwarze

BRIDGING SCIENCE FICTION AND TECHNOLOGICAL REALITY

The IVAM High-Tech Summit took place from May 7 to 8 at the Frankfurt. This year's theme centered on the intersection of science fiction and modern technology, exploring how imaginative concepts from films have become a part of our reality.

Through a series of presentations, workshops, and discussions, the conference highlighted the transformative impact of technological advancements inspired by cinematic visions.

Technological Innovations in Medical Science

One of the key areas of focus at the conference was medical technology. Attendees learned about groundbreaking innovations such as a laser-based, needle-free injection method designed to overcome needle phobia, and nanocapsules serving as carriers for RNA medications. These advancements, once purely fictional, are now revolutionizing medical diagnostics and treatments. The concept of lab-on-a-chip biopsies, initially a sci-fi dream, is now a reality, enabling more efficient and accurate diagnostic procedures.

The conference also shed light on neuroimplants, including the challenges of developing adequate testing criteria and the potential of elastic titanium tissue for closing wounds and repairing defects, such as hernias. These innovations underscore the significant strides made in medical technology, turning science fiction into tangible solutions.

IVAM
HIGHTECH 2024
SUMMIT

The Role of Artificial Intelligence in Industry

Artificial intelligence (AI) was a major topic of discussion, particularly its integration into production processes. The conference highlighted that while AI is a powerful tool for enhancing productivity, its effectiveness hinges on the quality and quantity of data available. Ethical considerations surrounding AI were also addressed, emphasizing the need for a balanced perspective that views AI as an aid rather than a threat to job security.

Sessions delved into the importance of customized intelligent security systems to address future security challenges, with quantum technology playing a pivotal role. Discussions included the potential of symmetric cryptography for highly secure communication, reflecting the crucial need for robust cybersecurity measures in an increasingly digital world.

Visionary Aerospace and Transportation Technologies

The summit featured an inspiring session on aerospace developments, organized by EPIC. Participants debated the challenges of deploying technology in the harsh conditions of space, contrasting the cinematic portrayal of seamless space travel with the current technological realities.

In the transportation sector, the “On the Move - Shaping the Future of Transportation” session by DETECT explored energy-efficient de-icing systems for drones

Dr. David Burzynski from Coldsense won the IVAM Innovation Prize for his innovative solution to prevent icing in cold storage rooms.

and aircraft, sensor technology to enhance train safety, and advancements in autonomous driving. These discussions underscored the importance of innovative technologies in shaping the future of transportation, inspired by imaginative concepts from films.

Smart Homes and the Future of Living

The conference also covered the evolution of smart homes, discussing the integration of intelligent building systems and digital infrastructure to enhance living conditions. This technology extends beyond private residences, offering significant benefits in medical contexts. Smart AI systems, for instance, can support elderly care, allowing individuals to live independently for longer and alleviating pressure on care facilities. These advancements demonstrate how futuristic AI technology is already making a tangible impact on everyday life.

Workshops and Keynote Speeches

Two workshops focused on AI's impact on the workforce and regulatory challenges. The first explored the new skills and organizational adjustments necessary to thrive in a digital working environment. The second examined the contrasting approaches to AI regulation between Europe and Asia, sparking a discussion on data protection and ownership.

The event also included a general meeting and a guided tour of the Frankfurt Film Museum. A keynote by Mr. Völkel from Focuslight shared his journey from Silicon Valley to Hollywood, encouraging attendees to seek mentors who inspire rather than control. Dr. David Burzynski from Coldsense won the IVAM Innovation Prize for his innovative solution to prevent icing in cold storage rooms. Finally, Mr. Zitt, a Star Trek expert, delivered a keynote on how early Star Trek films predicted many of today's technological developments. His speech highlighted the reciprocal relationship between cinematic creativity and technological innovation, emphasizing the enduring importance of imagination in driving technological progress.

The IVAM HTS 2024 successfully demonstrated that many of today's technological advancements have roots in the imaginative worlds of science fiction, underscoring the importance of creativity in technological development.

IVAM Microtechnology Network

www.ivam-hightech-summit.com

SMART PACKAGING: COMPACT, HIGH-PERFORMANCE ON-BOARD CHARGER

On-board chargers are the great equalizers for electric vehicle charging - and can be a game-changer for the future of e-mobility. Fraunhofer IZM has managed to bring together some of the most innovative ideas in power electronics to pave the way for a new generation of on-board chargers. Twice the performance at half the size, bidirectional capabilities, and efficiently machine-made: The resulting on-board charger is the economical ticket to the fast lane into the future.

Overcoming the limitations of traditional on-board chargers

Drivers lucky enough to find a high power charging (HPC) or other fast-charging stations can expect their electric cars to be charged and ready to go in around 15 to 30 minutes. That feat is made possible by the massive power packed into these chargers, with some types delivering up to 350 kW. And that power is delivered in DC form, just as electric vehicle batteries need. This means charging the batteries directly without need for an on-board charger.

Not so with AC chargers, which are by far the more common type. They range from the common household socket found in most garages, offering up to 3 kW on a single phase of AC current. More promisingly, three-phase AC current from regular public e-vehicle charging points or domestic wallbox-type chargers can charge batteries with up to 22 kW, allowing the batteries of many cars to be filled completely in about four hours. However, many of the e-vehicles currently in use are designed to take in a maximum of 11 kW - a bottleneck created by the on-board charger (or OBC) they are fitted with. Current OBCs are typically made from a number of separate components, including large coils, that are often made and assembled manually and take up a lot of space in the vehicle. Many electric car makers offer an optional upgrade from 11 to 22 kW, either by fitting a second OBC or using a larger module. Both options come at a premium, both in cost and space, and most OBC work only unidirectionally, that is, only for charging the car battery. They could not feed stored power back into the grid or allow parked electric cars to act as a type of buffer for domestic solar power systems. The promise of electric vehicles coming to the rescue of the green energy transition as a distributed energy storage network remains a pipe dream with the old technology.

Sinus amplitude converter with gallium nitride semiconductors for speeds above 1 MHz

Breaking through this technological barrier meant that Fraunhofer IZM had to develop not one, but several new components and find a way to fit them together in a tiny package. One key component is a sinus amplitude converter (SAC), a resonant high-frequency transformer. Its primary mission is to ensure that the car battery is galvanically isolated from the public grid, because the parasitic earth currents created by the on-board capacitors could cause a ground fault in the circuit and stop the system from working. The innovative part of the new SAC is the gallium nitride (GaN) switches used in the Fraunhofer IZM design -novel, high-performance semiconductors with a wide bandgap that make it possible to switch the converters at a frequency of 1.3 MHz or 1.3 million times per second. Oleg Zeiter, who oversaw Fraunhofer IZM's work on the new OBC, explains: „These high frequencies mean that we can

“Fast charging made easy: overcoming the limitations of traditional on-board chargers in Electric Vehicles”

totally rethink how we design the module.“ This has a direct effect on another essential component: the PFC choke.

PFC inductor – Flat coils, machine-made

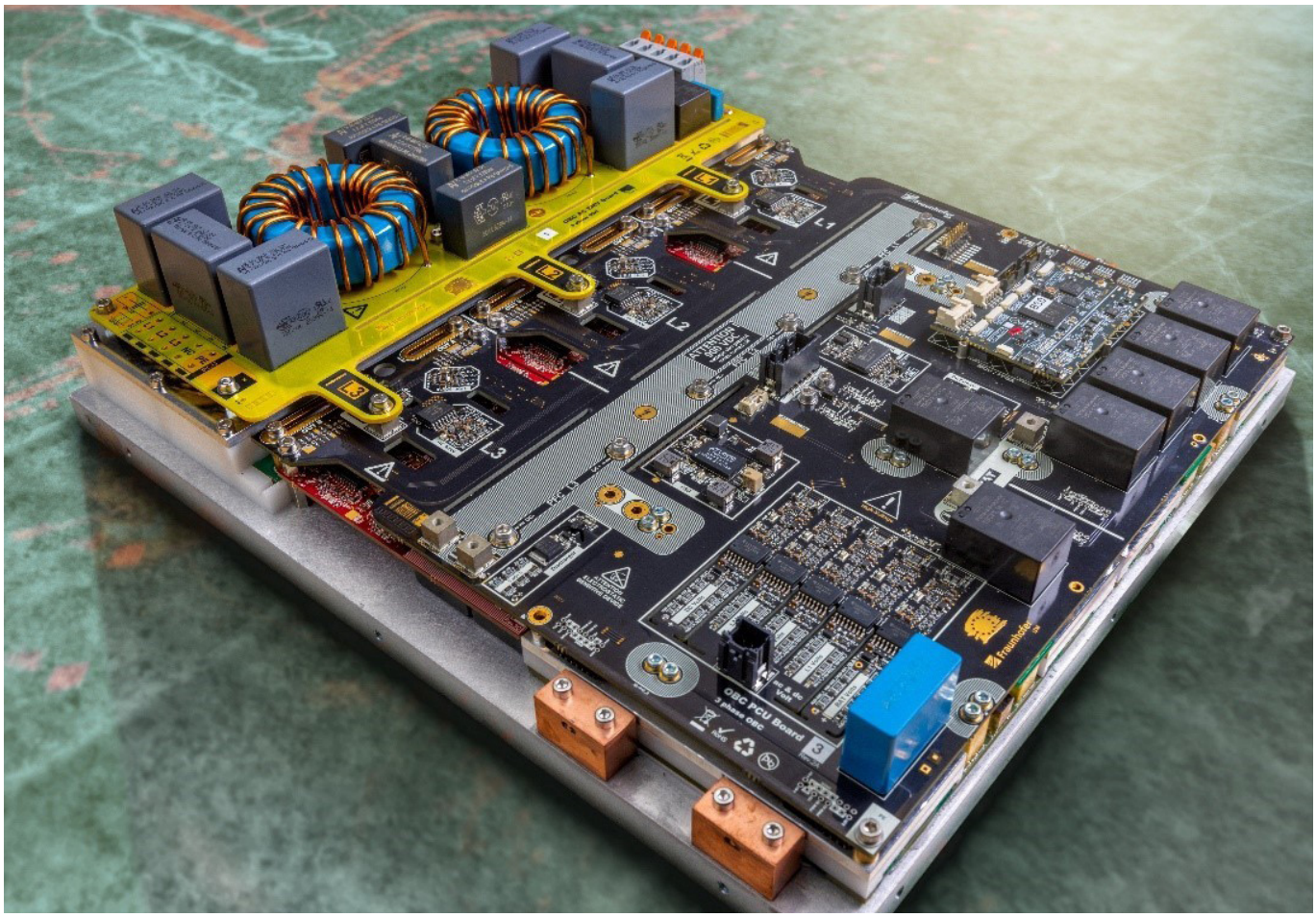
An OBC has one other key component, called the Power Factor Correction (PFC). It acts as the bridge with the public grid and gives the incoming alternating current a stable sinus shape at - depending on the local grid - 50 or 60 Hz. To do so, it uses chokes, a very bulky and very costly part in the conventional OBC designs. Fraunhofer IZM now uses a flat PFC inductor designed in circuit board form that has four magnetically coupled coils on a shared ferrite core. The PFC choke is not only much smaller; it can also be made by machine, instead of by hand. The planar design means that the choke can only generate lower inductivity, but this is no issue for the PFCs fitted with SiC switches and working at 140 KHz. „The low inductivity does not pose a problem for us, because we ramped up the switching frequency,“ Oleg Zeiter explains. „Because we only ever switch on the current for an extremely brief moment in time, it never reaches high amperage, even at low inductivity - all thanks to the quick switching.“

The smart packaging and interconnection techniques employed by Fraunhofer IZM finally allowed the Institute to create an OBC that is a mere three cubic decimeters in volume: half the size of conventional OBC, but with double the charging capacity at 22 kW. „In essence, we are just working with one big circuit board. Our packaging solutions mean that we can have a machine fit everything we need on this board,“ Oleg Zeiter says. In practice, this means a major reduction in production cost.

But these are not the only advantages of the new OBCs: The module can accommodate 400 and 800 V batteries and works at more than 97 percent efficiency. And the new OBC can let currents flow in both directions, from the grid to the battery and back again. This means that one of the basic questions of the energy transition has been resolved, at least from a technical standpoint, a feat made possible with support from the ECSEL JU initiative (Electronic Components and Systems for European Leadership Joint Undertaking) as part of the Horizon 2020 research and innovation program.

Fraunhofer Institute for Reliability and Microintegration IZM

https://www.izm.fraunhofer.de



The IZM on-board charger accelerates car battery charging and reduces production costs. Source: Fraunhofer IZM | Volker Mai

MICROFLUIDICS MEETS SENSORICS

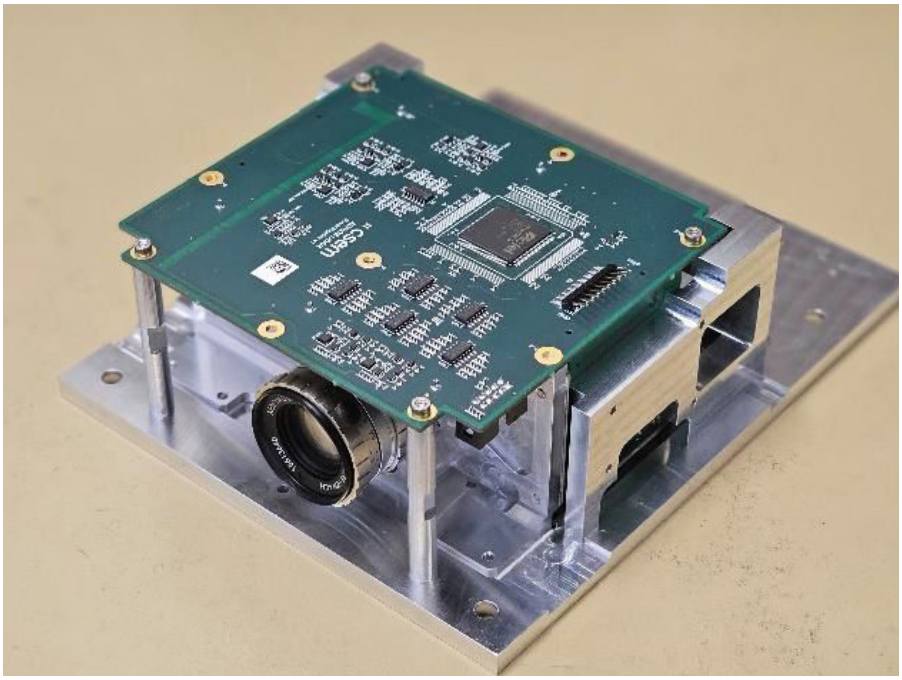
What advantages does the combination of sensorics and microfluidics offer for the development of innovative systems? At the next digital meeting of the IVAM Microfluidics Focus Group, we therefore want to discuss the topic „Microfluidics meets Sensorics“. The meeting will take place digitally on Wednesday, July 03 2024, from 12:00 to 1:30 p.m. (CEST).

https://www.ivam.de/events/ivam_focus_group_microfluidic_july

AUTONOMOUS NAVIGATION SYSTEM TO COMBAT SPACE DEBRIS

In just 60 years, space has accumulated millions of pieces of debris, posing a growing threat to infrastructures like the International Space Station and satellites. With Innosuisse support, ClearSpace, CSEM, EPFL, and Klepsydra have developed a flash lidar-based autonomous navigation system for In-Orbit Servicing (IOS).

According to the European Space Agency, over 35,000 objects over 10 cm and 130 million smaller pieces are orbiting Earth at high speeds, threatening active satellites and astronauts. The growing space industry needs cost-effective and sustainable solutions, making IOS crucial for removing failed satellites and extending their lifespan through refueling or repairs.



Flash lidars offer a robust navigation solution for rendezvous and docking, producing 3D images with a single laser pulse. ClearSpace's autonomous navigation system, developed with CSEM, EPFL, and Klepsydra, includes deep learning models for 6D pose estimation and a Guidance, Navigation, and Control subsystem. CSEM's contribution has been pivotal in making lidars smaller, stronger, and smarter for space applications.

ClearSpace aims to integrate this technology into upcoming missions and invites potential partners to collaborate on advancing space sustainability.

CSEM Centre Suisse d'Electronique et de Microtechnique SA

www.csem.ch/en
www.clearspace.today

QUIX QUANTUM UNLOCKS KEY TO SCALING PHOTONIC QUANTUM COMPUTING

Researchers using QuiX Quantum's technology have successfully generated Greenberger-Horne-Zeilinger (GHZ) states on-chip, a crucial step for advancing photonic quantum computing. This achievement positions QuiX Quantum as a leader in the field and supports their roadmap toward scalable universal quantum computers.

GHZ states involve entangling three photonic qubits, essential for building larger, more complex entangled structures needed for quantum computations. QuiX Quantum's technology enables the production and maintenance of these states, a key requirement for scaling quantum computers. This milestone marks significant progress since the demonstration of quantum advantage in photonic quantum computing.

In photonic quantum computers, information travels at light speed through flying qubits of light, in contrast to stationary qubits in matter-based quantum computers. The GHZ states allow these computers to maintain and process information effectively.

QuiX Quantum's integrated photonics technology, which operates at room temperature with minimal losses and full programmability, has been commercially available since 2022. This breakthrough demonstrates the transition from experimental to practical applications, heralding a new era in scalable quantum computing.

Dr. Stefan Hengesbach, CEO of QuiX Quantum, emphasized the significance of this milestone for the industry, highlighting the potential for large-scale quantum computation. Chief Scientist Dr. Jelmer Renema expressed excitement over the validation of their technology and the next challenge of scaling the production of GHZ states.

QuiX Quantum

https://www.quixquantum.com

IVAM MARKETING AWARD ASIA @ MMA

Participation in the IVAM Marketing Award Asia @ MMA is exclusive to exhibitors of MEDICAL MANUFACTURING ASIA 2024 (Sep 11 - 13, 2024, Marina Bay Sands, Singapore, SG) who can apply by submitting a nomination form by July 31, 2024. Finalists will present their marketing strategies at the event, showcasing their achievements to industry peers and experts.

www.medmanufacturing-asia.com/IVAM-Marketing-Award-Asia

FDA APPROVES EARLY FEASIBILITY STUDY FOR STROKE REHAB WITH CORTEC'S BRAIN IMPLANT

CorTec has announced today that the US Food and Drug Administration (FDA) has approved an Investigational Device Exemption (IDE) application by the University of Washington School of Medicine (UW) involving the closed-loop Brain Interchange Implant System. This clinical study will investigate a novel stroke rehabilitation treatment using cortical stimulation to enhance plasticity within the brain. With the clearance of the Brain Interchange System for human use CorTec is prepared to serve clinicians and research groups with its advanced implant technology to investigate novel treatment options for neurological diseases.

With the Brain Interchange System, CorTec aims to provide a fully implantable closed-loop Brain-Computer Interface (BCI) to clinicians for the investigation of therapies. According to CorTec CTO Dr. Martin Schuettler, this closed-loop functionality provides new possibilities for highly individualized treatments. He states, "The system is capable of interchanging information between biology and technology, between brain and computer. That's why we call it CorTec Brain Interchange. With our system, we are providing the technological tools that are needed to develop new therapies and brain-computer interface applications."

With FDA clearance secured, CorTec joins forces with partners in the USA to continue the development of novel therapies. The first IDE study1 involving the Brain Interchange System will be conducted in collaboration with one of the world's leaders in the field, principle investigator professor Jeffrey G. Ojemann from the University of Washington School of Medicine in Seattle as well as Prof. Steven C. Cramer from the University of California Los Angeles and their respective teams. With funding by the US-American National Institutes of Health (NIH)2, the consortium aims at obtaining initial first-in-human safety data and at the development and evaluation of novel therapeutical rehabilitation approaches for upper limb impairment in stroke patients via direct cortical electrical stimulation delivered by the Brain Interchange System. Enrollment of patients and the first implantation of the neural interfacing system are schedule for the third quarter of 2024.

Assistant Professor Dr. Jeffrey Herron from University of Washington is a co-investigator of the NIH funded study and the engineering lead on the project. He explains the importance of the FDA approval for the upcoming IDE study: "In the United States, all studies involving devices which pose a significant risk require the approval by both the FDA and institutional review board prior to participant recruitment. The FDA review of Investigational Device Exemptions for significant risk device studies is a rigorous process involving the submission of extensive documentation by both UW, the research site, and CorTec, the device manufacturer. The FDA makes their determination for a specific study based upon the details of the study protocol, an extensive hazard analysis, and an in-depth evaluation of the manufacturer's documents pertaining to the design and testing of the device to ensure that it will perform as needed for the study. The fact that UW and CorTec have now received this IDE approval from FDA is an absolutely critical milestone demonstrating a readiness to proceed towards participant recruitment for this study, pending local UW IRB approval."

CorTec GmbH

https://www.cortec-neuro.com

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SCAN ME

TDLAS GAS SENSING TECHNOLOGY FOR MEDTECH

Cubic TDLAS Gas Sensing Technology for Medical Applications

TDLAS (Tunable Diode Laser Absorption Spectroscopy) technology utilizes a “tunable” laser to emit light at precise wavelengths absorbed by specific gases. Within the context of medical applications, TDLAS gas sensors measure the intensity of the light absorption to accurately detect and quantify gases including oxygen (O2) with rapid response times and high reliability. Because of these advantages, TDLAS technology is a superior alternative to traditional paramagnetic oxygen detection methods in various medical applications.

With 20-year dedication to the development of gas sensing technologies, Cubic, an international manufacturer of advanced gas sensors and gas analyzers, has accumulated diverse mature sensing technology platforms. Based on the principle of TDLAS, Cubic has designed oxygen sensor Gasboard-2510 for accurate oxygen concentration measurement, realizing high accuracy and excellent repeatability, with a measurement range of 0 % to 100 % and a resolution of up to 0.01.

Utilizing narrowband tunable laser emission targeting oxygen absorption band, Gasboard-2510 achieves high selectivity of oxygen gas. Moreover, it boasts fast response time of less than 170 milliseconds.

As a result, Gasboard-2510 oxygen sensor can be widely applied in anesthesia machines that demand accurate, reliable, and rapid oxygen concentration measurements.

Cubic Sensor and Instrument Co.,Ltd
https://en.gassensor.com.cn

FRAUNHOFER MATCH: COLLABORATION BETWEEN INDUSTRY AND RESEARCH

Companies can now use the digital platform Fraunhofer Match to connect with experts within the Fraunhofer Society for tailored research solutions. This platform allows secure, confidential inquiries and facilitates quick access to competent conversation partners and initial solution approaches.

Fraunhofer Society
www.match.fraunhofer.de

AVEM MARKET SOLUTIONS TO REPRESENT ACCUMOLD IN IRELAND AND UK

Accumold has appointed Avem Market Solutions to represent its micro injection molding capabilities in the medical technology, microelectronics, wearable, and micro-optics sectors in Ireland and the United Kingdom.

Based in Galway, Ireland, Avem is well-established in the medical OEM sector and is equipped to represent Accumold's micro molding solutions to both existing and new customers. These customers are working on next-generation products that require micro sizes, micro tolerances, or micro features.

Founded in 1985, Accumold specializes in molding very small parts that other companies cannot produce. The company focuses on innovation to produce critical components accurately, cost-effectively, and promptly.

Avem's expertise in technical sales and knowledge of various medical applications, materials, and manufacturing processes enable them to connect R&D and commercial teams with the right solutions for device miniaturization. Accumold looks forward to this partnership with Avem.

Emmet Hanly has been assigned to manage the Accumold account in Ireland and the UK, supported by both the Accumold and Avem teams. He will be the main contact for new projects and business development inquiries in these regions.

Accumold

www.avemmarketsolutions.com
www.accu-mold.com

ASIA PHOTONICS EXPO 2025

DISCOVER THE FUTURE OF PHOTONICS AT APE!

Asia Photonics Expo (APE) will be held from March 5.-7, 2025 in Marina Bay Sands Singapore. With the ambition to become the world's leading holistic photonics platform for business connection, APE focuses on showcasing the latest cutting-edge technologies for the emerging application markets in Asia and the world. The goal is to promote in-depth communication and foster business collaboration between professionals in the whole supply chain of the photonics industry.

APE is the first photonics exhibition in the ASEAN region, providing an exceptional opportunity to expand your business in the fast-growing markets of Asia. With an efficient and effective platform for business and technical exchanges, APE allows you to obtain the latest market information and connect with your target customers and suppliers from various photonics industry application fields.

Spanning 15,000 square meters, APE will host around 400 exhibitors from various sectors, including: optical communication, information processing & storage, consumer electronics, advanced manufacturing, semiconductor processing, sensing & measurement, medical energy, lighting & display, defense & security.

APE will attract a wide range of buyers and audiences from different application industries, ensuring that you meet your target audience at the event. By participating in APE, you will have the opportunity to get in touch with key decision makers and potential collaborators across these industries.

https://www.ivam.de/events/asia_photonics_expo_2025

GET TO KNOW IVAM MICROTECHNOLOGY NETWORK - JOIN A Q&A SESSION

Have you ever thought about whether your company could benefit from a membership in a network? Perhaps an IVAM membership may be the right solution for current challenges in your microtech-, biotech- oder deeptech-company! We cordially invite you to get to know the network better. You are welcome to bring specific questions, which we will then answer personally. Additionally you have the possibility to arrange an individual appointment.

sh@ivam.de

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EVENTS

19 June 24

MID-WEEK COFFEE BREAK – IMS @

Virtual technology talk between IVAM Members

03 July 24

IVAM FOCUS GROUP MICROFLUIDICS @

Microfluidics meets Sensorics

04 July 24

IVAM EXECUTIVE CLUB MEETING

Change of leadership in medium-sized companies - opportunities and challenges.
BioMedizinZentrumDortmund, Dortmund, DE

21 Aug 24

MID-WEEK COFFEE BREAK – FRAUNHOFER FEP @

Virtual technology talk between IVAM Members

11-13 Sep 24

MEDICAL MANUFACTURING ASIA 2024

Manufacturing Processes for Medical Technology, Singapore, SG

17 Sep 24

SMART VIDEO MARKETING FOR B2B WITH AI@

B2B online training for SMEs in September/October 24

26 Sep 24

IVAM FOCUS GROUP PHOTONICS

Focus Group Session at W3+ Fair in Jena, DE

11-14 Nov 24

COMPAMED

Product Market “High-tech for Medical Devices” and “COMPAMED HIGH-TECH FORUM”
Düsseldorf, Germany, DE

13 Nov 24

EUROPE MEETS USA - PART 5 AT COMPAMED

High-tech for Medical Devices, Düsseldorf, Germany, DE

04-06 Feb 25

MD&M WEST 2025

Medical Design & Manufacturing - IVAM presents Micro Nanotech Area

05-07 Mar 25

ASIA PHOTONICS EXPO 2025

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