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PRESS RELEASE

When the hip joint comes out of the printer

Fraunhofer-Gesellschaft's German-Polish High-Performance Center brings additive manufacturing to medical technology – first demonstrators will already be presented by the end of 2021

(Dresden, June 28, 2021) It's all about high-tech dentures, prostheses that autonomously detect inflammatory reactions in the body, or individually adapted seats for wheelchairs. A German-Polish Fraunhofer-Gesellschaft High-Performance Center is researching new technologies for the use of 3D printing processes, known as additive manufacturing technology, in medical technology. For Fraunhofer-Gesellschaft, it is one of two international High-Performance Centers launched in March that are explicitly dedicated to cross-organizational cooperation. The Fraunhofer Institute for Material and Beam Technology IWS in Dresden and the Fraunhofer Institute for Machine Tools and Forming Technology IWU in Chemnitz are involved in the "Additive Technologies for Medicine and Health" (ATeM) Center on the German side. They cooperate with the Faculty of Mechanical Engineering and the Center for Advanced Manufacturing Technologies (CAMT) at Wroclaw University of Science and Technology. The German Federal Ministry of Education and Research is providing financial support for the project.

Additive technologies offer interesting opportunities, particularly for manufacturers in the medical technology sector. 3D printing allows individual solutions tailored to the patient as well as the integration of new, improved properties and functionalities into components. This is usually not only more cost-effective than conventional processes but also allows to provide novel therapies and treatment approaches. The ATeM High-Performance Center, founded in 2021, aims at turning additive manufacturing into an established standard tool in medical technology in the years to come. At the end of this year, the project partners are planning to present their first demonstrators.

The scientists are currently investigating new application areas in several individual projects. One project is focusing on the prospects for 3D printing in dentistry. "There is great potential in the use of innovative materials and the integration of additional functionalities in dental prostheses to increase the wearing comfort for the patient," explains Prof. Dr. Frank Brückner, Technology Field Manager Additive Manufacturing

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and Printing at Fraunhofer IWS. Additive manufacturing might allow significantly more complex implants to be printed immediately after a 3D scan of the oral cavity, thus reducing waiting times. Additive processes could also be used, for example, to combine metal and plastic materials for improved aesthetics.

Smart hip joints: Sensors and fibers open up new possibilities

Another application scenario focuses on functional enhancements, such as the direct integration of sensors into medical components. Sensitive sensors in additively manufactured knee or hip joints could detect inflammatory reactions after surgery by reacting to higher temperatures or altered biomarkers. In future, lab-on-a-chip systems will also be printed, enabling the simulation of organ functions and processes in the human body to be displayed on a chip. Thus, it might become possible to investigate pharmaceuticals without the need for animal tests.

In two projects led by Fraunhofer IWU, scientists are currently investigating how fiber-reinforced 3D structures can be printed. "We can achieve a product design suitable for loads, yet also being very light-weight, by using reinforced fibers that we introduce directly into the plastic matrix," explains Prof. Dr. Lothar Kroll, Scientific Director Lightweight and Textile Technologies at Fraunhofer IWU. For example, this could be used to print cranial implants using the biocompatible thermoplastic polyetheretherketone (PEEK). The researchers are also currently working on individually adapted seats for wheelchairs and high-strength orthoses.

Patients will soon benefit from the results

A Fraunhofer Project Center managed by Fraunhofer IWS and the CAMT of TU Wroclaw has been established in 2008. "We are pleased that with the new High-Performance Center we can now further expand the synergy effects of this successful collaboration," says Prof. Dr. Edward Chlebus, former Dean of the Faculty of Mechanical Engineering at TU Wroclaw. The model of the High-Performance Centers, which has already been tested for many years in Germany by the Fraunhofer-Gesellschaft, has a strong focus on knowledge transfer and industrial cooperation. It is

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now also providing important cross-organizational impetus for strengthening the European economy.

"All partners are experts in the field of additive manufacturing," emphasizes Robin Willner, scientist at Fraunhofer IWS and office manager of the German-Polish High-Performance Center. He adds that TU Wroclaw has very close ties to the medical faculty there. "Together, we now gain an excellent insight into where needs exist, where solutions have not yet been found and where additive technologies could create added value in medical and healthcare sectors."

As early as the end of the third quarter of 2021, the project participants plan to present the first demonstrators for the individual projects. This rapid implementation is possible because the partner institutions have already created essential basics for the current research in preliminary studies over the past. The ideas for new medical products and therapies are expected to benefit patients in the near future through industrial collaborations and possible spin-offs.

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Scientists in Germany and Poland are researching new technologies for the use of 3D printing processes in medical technology in one of two international Fraunhofer High-Performance Centers.
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Today, orthodontic distractors are manufactured as a standard part and only adjusted during the surgical process: tedious and uncomfortable for the patient. Additive manufacturing is designed to shorten lead times and enable an individualized fit for the patient.
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The **Fraunhofer Institute for Material and Beam Technology IWS Dresden** develops complex system solutions in materials and laser technology. We define ourselves as idea drivers developing customized solutions based on laser applications, functionalized surfaces as well as material and process innovations – from easy-to-integrate custom solutions to cost-efficient solutions for small and medium-sized enterprises to industry-ready one-stop solutions. Our research focuses on aerospace, energy and environmental technology, automotive, medical and mechanical engineering, toolmaking, electrical engineering and microelectronics, and photonics and optics sectors. In our five future and innovation fields of battery technology, hydrogen technology, surface functionalization, photonic production systems and additive manufacturing, we are already creating the basis today for the technological answers of tomorrow.

Fraunhofer Institute for Machine Tools and Forming Technology IWU is a driver for innovations in the research and development of production engineering. Around 670 highly qualified employees at our locations in Chemnitz, Dresden, Leipzig, Wolfsburg, and Zittau tap the new potential for competitive manufacturing in automotive and mechanical engineering, aerospace technology, medical engineering, electrical engineering, and precision and micro engineering. We focus on components, processes, methods, and complex machine systems – the entire factory. As the leading institute for resource-efficient production, our objectives comprise technologies based on renewable energies, utilizing novel information technologies and visualization methods for humans guaranteeing success in tomorrow's factory.

Dental prostheses like these are currently produced by hand in a laborious process. "ATeM" wants to make the production of prostheses faster as well as more comfortable and efficient in terms of costs and resources.
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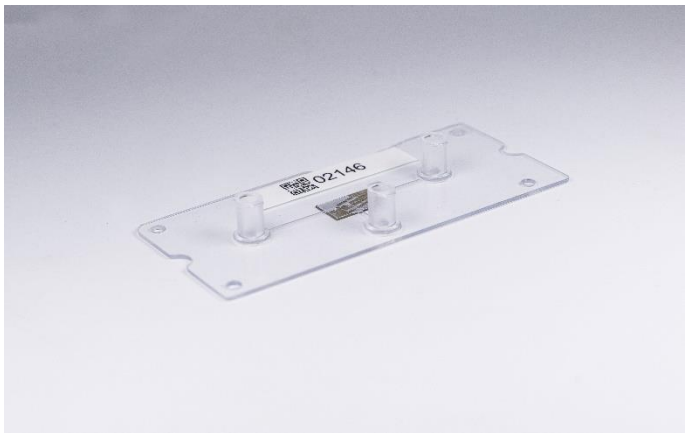

In the future, lab-on-chip systems shall replace animal testing and enable the patient-specific use of pharmaceuticals. "ATeM" is focusing on the production of these systems in order to integrate filigree semiconductor systems in a direct, biocompatible and fluidically tight way.
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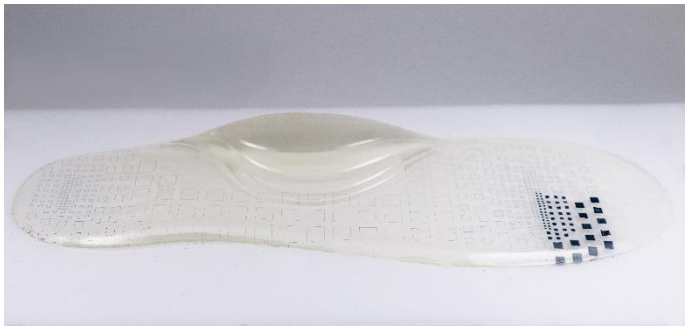

Piezo sensors embedded in orthopedic inlays shall help analyzing the body balance and thus preventing posture problems.

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CAMT laboratory at Wroclaw University of Science and Technology.

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The Fraunhofer-Gesellschaft's International High-Performance Center "ATeM" is taking additive manufacturing to the medical technology industry.

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