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PRESS RELEASE

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Life-long implants – vision and state of the art

The Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP, one of the leading R&D partners for thin-film technologies, applications of electron beams, and surface treatments, together with the Fraunhofer Institute for Machine Tools and Forming Technology IWU, a center for development of medical technology component and production processes, have merged their expertise in order to advance a new generation of medical implants. The first results of this partnership will be presented by the two Institutes at the annual conference of the German Society for Biomedical Engineering (DGBMT) in Dresden on September 10-13, 2017.

Implants are routinely employed in hospitals and dental practices daily. They are technologically mature and offer support for people in many different ways. The interventions themselves are burdensome for the patient and continue to be fraught with risks. Researchers of the Fraunhofer FEP and IWU are working jointly on developing life-long implants in order to extend the service life of these components in the body.
"The Fraunhofer IWU conducts research on materials that have morphological memories – they remember and return to their original shape after deformation – such as used in vascular stents," explains Christian Rotsch, head of the Medical Engineering department at Fraunhofer IWU. "These are materials that are able to resume their prior shape once triggered by a thermal stimulus."

The advanced incremental fabrication process known as 3D printing, allowing personalized, patient-specific solutions to be realized, is also a research focus at Fraunhofer IWU. At the same time, this process allows hermetically sealed, active components to be integrated. Non-invasive external control over the implant thereby becomes feasible for the patient – without medical intervention. As part of the development of these components and the necessary technology for integrating them, Fraunhofer IWU is working together closely with scientists of the Fraunhofer Institute for Ceramic Technologies and Systems IKTS.

Every individual reacts differently to an implant. In order to facilitate improved engraftment and minimize complications, surface properties of the implants can be enhanced. Implants must be robust and biologically compatible with cells in order to be able to remain in extended service and not be rejected by the body. This is where the surface treatment expertise of the Fraunhofer FEP finds application. A stable barrier to prevent the diffusion of ions or other cytotoxic constituents can be achieved through suitable coating and modification of many substrate materials, for example.

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"Implants containing nickel are coated and modified in a way that prevents allergies from being triggered in patients, and additionally that cell growth on specific areas of the surface can be selectively promoted or hindered," explains Gaby Gotzmann, Project Manager in the Medical Applications Group at Fraunhofer FEP. "Biological functionalization through the utilization of low-energy electron-beam technology has proven to be especially advantageous in comparison to prior processes, since temporally stable effects can be attained with e-beams. Moreover, this technology is suitable as well for sterilization of medical surfaces and components, whereby implants with integrated electronic components and delicate constituent materials are able to be safely and thoroughly sterilized."

Because the technologies described here are application- and substrate-specific, all processes must be adapted and matched to new potential applications. The Fraunhofer FEP and IWU Institutes offer development of application-specific coating and surface modification technologies – from lab-based proof-of-concept through to complete system solutions including hardware development for industrial and scientific partnering organizations.

The Fraunhofer IWU and FEP Institutes are partners in the Fraunhofer Lighthouse project to develop pivotal technologies for medically approved theranostic implants ("Theranostische Implantate Zulassungsrelevante Entwicklung von Schlüsseltechnologien").

www.fraunhofer.de/de/forschung/fraunhofer-initiativen/fraunhofer-leitprojekte/fraunhofer-theranostische-implantate.html (German)

Fraunhofer FEP at the annual conference of the German Society for Biomedical Engineering (DGBMT) taking place in Dresden September 10-13, 2017.

Booth 14

Conference Presentation: "Low-energy electron-beam sterilization for novel interactive implants and their components"
11:24 am – 11:42 am, V 132, J. Schönfelder, J. Portillo, G. Gotzmann, M. Dietze, F.-H. Rögner
Tuesday, September 12, 2017
Session 38 – "Organ and Patient Support Systems II" (Organ- und Patientenunterstützungssysteme II)
Room: Conference 1

Poster session: "Long-term stable surface modification of DLC-coatings"
P 162, G. Gotzmann
Monday, September 11, 2017, 15:15- 16:15 in Cells, Materials, and Biochemistry I (Zellen, Materialien und Biochemie I).

Fraunhofer IWU at the annual conference of the German Society for Biomedical Engineering (DGBMT) taking place in Dresden September 10-13, 2017.

Booth 15

Conference Presentations: "Concept of an implant with an integrated sensor actuator system for the monitoring and influencing of the mechanical implant bone interface"
10:30 am–10:45 am, V 65 H. Lausch, T. Töppel, E . Hensel, M. Brand, K. Gille, C. Rotsch
Monday , September 11, 2017
Session 18 „Organ and Patient Support Systems I" (Organ- und Patientenunterstützungssysteme II)
Room: Conference 1

In addition, Fraunhofer IWU will be presenting research and clinical results from joint research projects in association with its partners from industry as part of the networking session.

"Treatment options for diseases of the locomotor system ("Möglichkeiten der Therapie von Erkrankungen des Bewegungssystems")
03:15 pm–04:15 pm, Chair: C. Rotsch, R. Grunert
Monday, September 11, 2017
Network Session III
Room Foyer

"Modular systems and lightweight construction concepts – new for the defect-specific treatment of hip-joint diseases"
03:15 pm –03:27 pm, NW 13, T. Prietzel, M. Schmidt, M. Kopper, T. Töppel, S. Hanus, R. Grunert

"Development of a measuring system for the investigation of the force and the damping between THA-shaft and –head"
03:27 pm –03:39 apm, NW 14, T. Wendler, D. J. Zajonz, S. Schleifenbaum,T. Prietzel

"Applied research in the field of medical engineering in interdisciplinary networks of physicans and engineers – challenges and results"
03:39 pm–03:51 pm, NW 15, C. Rotsch, R. Grunert, M. Werner, L. Mehlhorn

"Non-invasive measurement of electroencephalographic and electromyographic signals for the development of a cerebrally controlled muscle-stimulation system"
03:51 pm–04:03 pm, NW 16, M. Löffler, N . Spahn, M. Heilemann, D. Wetzel, E . Stark, R. Hinderer, S. Kolbig, M. Seidel, D. Winkler

"Accuracy study of a 3D-printed patient-specific brain biopsy system for veterinary medicine"
04:03 pm–04:15 pm, NW 17, M. Müller, D. Winkler, R. Möbius, T. Flegel, S. Hanemann, S. Scholz, R. Grunert

Hip stem with integrated memory-retaining components from Fraunhofer IWU and barrier coating as well as surface modification by Fraunhofer FEP.
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Picture in printable resolution: www.fep.fraunhofer.de/press

About Fraunhofer FEP:
Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP works on innovative solutions in the fields of vacuum coating, surface treatment as well as organic semiconductors. The core competences electron beam technology, sputtering, plasma-activated deposition and high-rate PECVD as well as technologies for the organic electronics and IC/system design provide a basis for these activities. Thus, Fraunhofer FEP offers a wide range of possibilities for research, development and pilot production, especially for the processing, sterilization, structuring and refining of surfaces as well as OLED microdisplays, organic and inorganic sensors, optical filters and flexible OLED lighting.
Our aim is to seize the innovation potential of the electron beam, plasma technology and organic electronics for new production processes and devices and to make it available for our customers.

Further information: *www.fep.fraunhofer.de/en/Anwendungsfelder/Medizinische-Applikationen.html*

About Fraunhofer IWU:
The core expertise at Fraunhofer IWU in the medical technology area is the modeling of biomechanical systems, their design, and numerical simulation, as well as researching and employment of active materials. A further area of emphasis is the development of fabrication technologies for implants and components intended for medical applications. The chief research focus is on generative fabrication processes (laser-beam melting and fused deposition modeling (FDM)), precision and micro-fabrication techniques (microscale machining, micro-electrical discharge machining/µEDM, micro-electrochemical machining/µECM, and laser machining), and bulk deformation as well as manufacture of cellularly structured metal such as metallic foams.
Besides its sites in Dresden and Chemnitz, the Institute has been working jointly with physicians and engineers in Leipzig on new medical components and treatment processes in the center for research into support and locomotor organs (zesbo.de) at the Universitätsklinikum Leipzig university teaching hospital.
Through interdisciplinary networks comprising public hospitals, university teaching hospitals, research institutions, and manufacturers of medical products (kinetek.eu, kunstgelenk.eu), solutions to challenges can be developed at all points along the entire value-added chain, from concept, to technological implementation and clinical evaluation.

Further information can be found under
www.iwu.fraunhofer.de/en/research/range-of-services/Competence-from-A-to-Z/medical-engineering.html
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