KUNSTSTOFF TECHNIK LEOBEN

MATERIALS SCIENCE AND TESTING OF POLYMERS
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3D-Printable Medical Polymers

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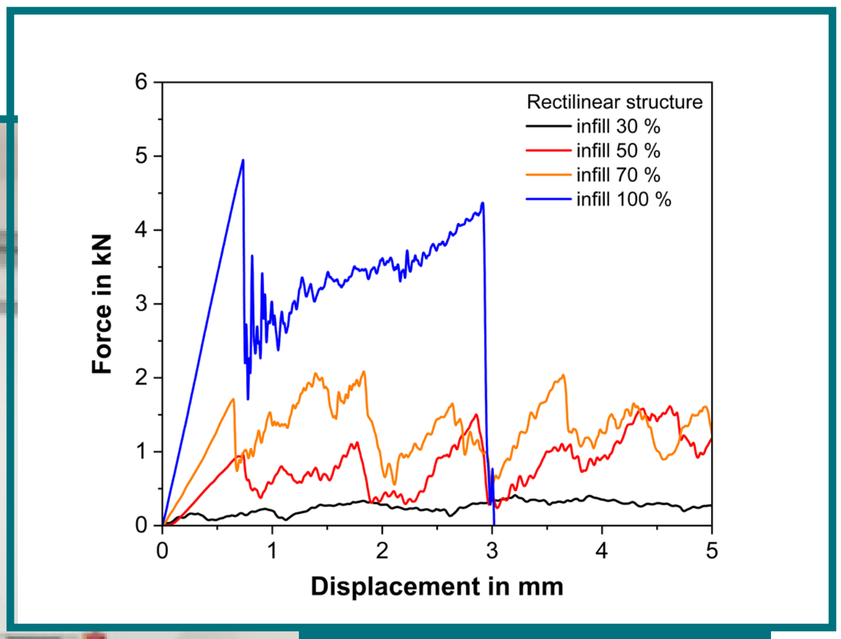
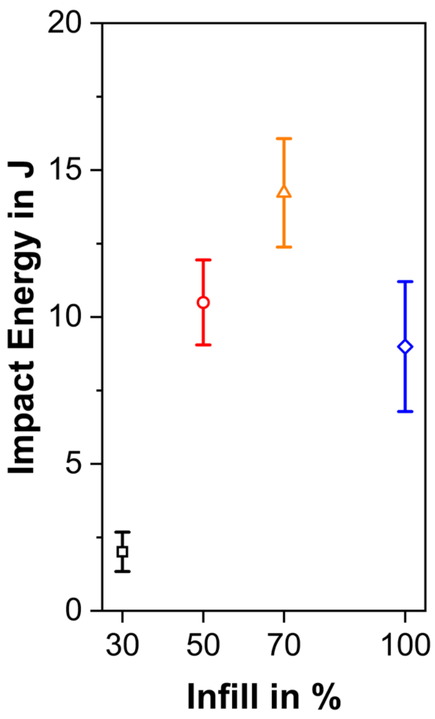
Material selection and mechanical characterization of 3D-printable polymers for medical applications.

Only a limited number of medical as well as 3D-printable polymers exist. PMMA, for example, is 3D-printable and already used as cranial reconstruction material. 3D-printing methods such as fused filament fabrication (FFF) are gaining more and more popularity in the medical sector. FFF is an extrusion-based additive manufacturing process, whereby the desired object is built layer-by-layer. Relating to implant materials, a reliable mechanical stability is required.

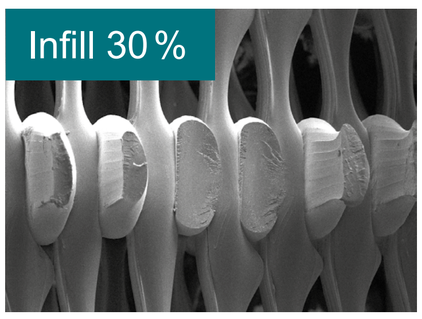


Drop-weight testing of 3D-printed PMMA plates

Impact energies depending on printing parameters



Infill 30 %



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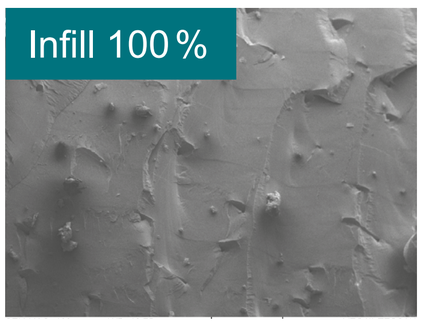

Fracture analysis after failure

The material properties are highly depending on the layer orientation and processing parameters. FFF-printed PMMA-plates with solid interfaces and different core infills (30 – 100 %) result in impact energies deviating by 10 J, occasionally followed by a change in the fracture mechanism. With the help of microscopic methods the fracture behavior after failure could be analyzed.

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RESEARCH FOCUS: 3D-printable polymeric materials for medical applications, mechanical characterization of 3D-printed components, mechanical impact testing

PROJECT: CAMed - Clinical Additive Manufacturing for Medical Applications

PROJECT PARTNERS: Medical University of Graz, JOHANNEUM RESEARCH Forschungsgesellschaft mbH, Max Planck Institute for Intelligent Systems - Perceiving Systems Department, MUL - Polymer Processing, TU Graz - Institutes of Engineering and Business Informatics & Computer Graphics and Vision, Apium Additive Technologies GmbH, ARBURG GmbH & Co KG, CAE Simulation & Solutions Maschinenbau Ingenieurdienstleistungen GmbH, Evonik Resource Efficiency GmbH, FARO Europe GmbH & Co KG, HAGE3D GmbH, Heraeus Deutschland GmbH & Co KG, Hofer GmbH & Co KG, Ionbond Austria GmbH, Lithoz GmbH, LSS Laser Sinter Service GmbH, Quadrant EPP USA, Inc., Voestalpine BÖHLER Edelstahl GmbH & Co KG

FUNDING: CAMed (COMET K-Project 871132) is funded by the Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT), the Austrian Federal Ministry for Digital and Economic Affairs (BMDW) & the Styrian Business Promotion Agency (SFG).