livMatS

UNI FREIBURG

Colloquium

Next generation 3D Printing: The emergence of enabling materials

Prof. Dr. Bastian Rapp, IMTEK, University of Freiburg

Abstract

Additive manufacturing and 3D printing have seen significant improvements in terms of processing and instrumentation with the aim of increasing the complexity of the objects constructible, increasing resolution and lateral dimensions as well as speed of manufacturing. Interestingly, the choice of materials has not been increasing significantly. Most 3D printing techniques still use polymers or composites (e.g., with ceramic particles). Selective Laser Sintering (SLS) is the only process which has been extended to include metals. One of the oldest materials mankind has used was missing: Glass. Account of man-made objects in glass date back to 5000 BC. Glass has numerous advantageous properties including unmatched optical properties, mechanical, thermal as well as chemical stability to name but a few. In 2016 we have contributed a prototyping process in glass which uses a glass nanocomposite which can cured by light and sequentially thermally annealed to result in highly-transparent fused silica glass [1]. With a recent contribution in *Nature*, this process was finally successfully transferred to 3D printing [2]. This closes an important gap in the material palette of modern 3D printing processes enabling, for the very first time, the free-form generation of highly transparent fused silica glass by a state-of-the-art 3D printing process. This has major implications for many applications ranging from 3D printing of complex lenses for smartphone cameras, next-generation microprocessors, all the way to ornaments or intricate glass panels used in buildings.

Literature

[1] F. Kotz, K. Plewa, W. Bauer, N. Schneider, N. Keller, T. Nargang, D. Helmer, K. Sachsenheimer, M. Schäfer, M. Worgull, C. Greiner, C. Richter, B. E. Rapp: “Liquid Glass: A Facile Soft Replication Method for Structuring Glass”, Advanced Materials, 28, 23, 4646, 2016.

[2] F. Kotz, K. Arnold, W. Bauer, D. Schild, N. Keller, K. Sachsenheimer, T. M. Nargang, C. Richter, D. Helmer, B. E. Rapp: "Three-dimensional Printing of Transparent Fused Silica Glass", Nature, 544, 337-339, 2017

Brief Bio

Bastian E. Rapp studied mechanical engineering at the University of Karlsruhe and finished his PhD at the same university in 2008 working on biosensors for biomedical diagnostics. In 2017 he finished his *Habilitation* at the *Karlsruhe Institute of Technology* with the publication of a textbook on fluid dynamics in microfluidics. His research focuses on the development of novel materials, processes and applications in microsystem engineering, life sciences and biotechnology as well as instrumental and clinical analytics. In October 2018 he joined the University of Freiburg as Full Professor of Process Technology. He is cofounder and CEO of the spin-off *Glassomer GmbH* which currently commercializes next-generation 3D printing processes for glass. For his work he was awarded, among others, the *Edison Prize* of the General Electric (GE) Foundation, the *REHAU award*, the *GMM award*, and the *Südwestmetallförderpreis*. In 2019 he received an *ERC Consolidator Grant* from the *European Research Council* for his work on tactile displays for the visually impaired.

27 May, 2020, 16:00-17:15 p.m. - Digital Colloquium

Gefördert durch DFG Deutsche Forschungsgemeinschaft

FIT

Fraunhofer ISE

Fraunhofer IWM

Öko-Institut e.V. Institut für angewandte Ökologie Institute for Applied Ecology