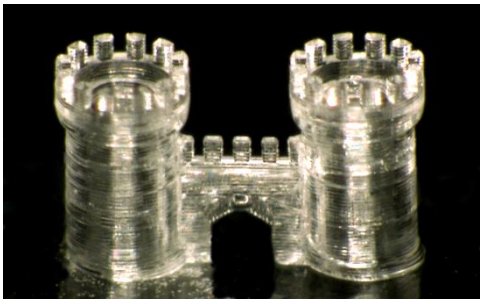
Master Thesis, code: 3Dceramics

3D printing of high-performance ceramics



3D printers for the fabrication of macroscopic parts have changed many industrial and customized fabrication processes. The revolutionary potential of 3D printing is however limited by the restricted choices of materials which can be processed. Many highly relevant materials like glasses and ceramics needed for life science or medical technology can so far not be processed. Our group strives for the development of novel nanocomposites which allow for 3D printing of high-performance materials. Recently we have developed a novel concept where we have shown for the first time that high-resolution printing of fused silica glass is possible (Kotz et al., *Nature*, 2017). The process is based on the development of a novel nanocomposite that can be processes in commercial 3D printers and is turned into high-quality glass in a consecutive sintering step.

Alumina ceramics are important for the development of extremely hard windows, highly-integrated optics and catalysts in chemical synthesis. In this work novel nanocomposites for the fabrication of these high-performance alumina ceramics will be developed. The work contains the following aspects:

1.) Development and optimization of nanocomposites for stereolithography (e.g. finding appropriate powders, dispersants and monomers, rheological characterization).
2.) Development of heating protocols for thermal debinding and sintering.
3.) Integration of these materials into a stereolithography printer and fabrication of test prints.
4.) Characterization of the sintered ceramics (e.g. bending strength, microstructure analysis).

Field of study: organic chemistry, material science, process engineering

Professional skills: You should have an excellent academic track record. Knowledge of organic chemistry and polymer chemistry is required. Basic knowledge of the fabrication of nanocomposites and of operating a stereolithography printer are beneficial.
Personal skills: You should be interested in working in an interdisciplinary team between engineering, material science and polymer chemistry. You should be eager to expand your knowledge. You should have good planning and time-management skills, as you may have to travel occasionally to external institutions such as KIT to execute measurements.

If you are interested please sent a letter of motivation, your CV and your academic track record.

For further information please contact:
Dr. Frederik Kotz
Frederik.Kotz@imtek.uni-freiburg.de
Lehrstuhl für Prozesstechnik
Institut für Mikrosystemtechnik
Georges-Köhler-Allee 103
Albert-Ludwigs-Universität Freiburg