

Development of nanocomposites for 3D printing of glass membranes

Glasses are versatile materials for many applications. Due to their material properties and nearly unlimited possibilities for surface functionalization, membranes, i.e. porous glasses are becoming increasingly important for, e.g. oil/water separation, development of super-repellent surfaces, biotechnology and medicine. Glass membranes are usually fabricated using phase separation of multicomponent glasses or using sol-gel methods. These methods allow only for limited freedom of design or structuring. 3D printing would allow for the fabrication of highly integrated membrane structures for the use in chemical synthesis and microtechnology.

We have recently developed a new method to fabricate fused silica glass using nanocomposites which can be shaped like a polymer and then turned into fused silica glass using thermal debinding and sintering (Kotz et al. *Advanced Materials*, 2016). Using this technology, it is for the first time possible to structure glasses in high resolution with nearly arbitrary shape using 3D printing (Kotz et al. *Nature*, 2017) or replication processes (Kotz et al. *Advanced Materials*, 2018). Until now this process is limited to dense and non-porous glasses. In order to expand this process to the fabrication of free formed glass membranes different polymer foaming techniques will be evaluated on their applicability to foam the developed nanocomposites and fabricate glass membranes with adjustable pore size and shape.

Your work will contain:

- 1.) Development of nanocomposites for the fabrication of porous glass membranes and evaluation of different polymer foaming mechanisms to fabricate glass membranes with adjustable porosity.
- 2.) Evaluation of other possible techniques for glass foaming.
- 3.) Integration of these materials into a stereolithography printer and fabrication of test prints.
- 4.) Characterization of the sintered glass membranes (e.g. SEM, porosimetry).

Field of study: organic chemistry, material science

Professional skills: You should have an excellent academic track record. Knowledge of organic chemistry is required. Basic knowledge of the fabrication of nanocomposites and polymer foaming technologies, e.g. integration of polymer nanoparticles, gas foaming, emulsion polymerization, 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 and motivate yourself.

If you're interested please send a letter of motivation, your CV and a list of your academic track record.

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