The design of inkjet inks suitable for the manufacturing of foamed polyurethane materials

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Processes that are dominated by interfacial interactions often require large surface areas. Porous polymers as a subgroup of porous materials, provide the advantage of easy manufacturing and handling compared to crosslinked particle layers. Porous polymers, more specified polyurethane based foams (PUF) are well known to the industry finding application in the fields of insulation, as general light weight materials [1] or in demanding fields such as scaffolds in tissue engineering [2].
The focus on this contribution will be set towards the transfer from the bulk porous polyurethane foam into inks that can be used as reagents suitable for reactive inkjet printing [3, 4]. First, the materials of interest were tested for their generally usage as PU-reactants in bulk preparation, focusing on low viscous fluids. Characterization by means of rheology and tensiometry was then used to assure printability in inkjet processes. Moreover, the boarders of the selected materials were defined in which different material properties could be obtained by changing the amount e.g. of the multifunctional polyol used within the ink.
The formation of polyurethane requires the preparation of two separate inks, one containing an isocyanate, and the second containing a multifunctional diol. We identified aliphatic isocyanates e.g. 1,6-hexamethylene diisocyanate (HDI) combined with a mixture of poly(ethylene glycol) 200 and glycerol ethoxylate as a suitable combination to create inks that can form porous structures by placing droplets on top of each other in a layer by layer procedure. Furthermore, FTIR-spectroscopic studies were carried out in order to describe the kinetics of the reactants. Using an expermiental design it was possible to describe the effects caused by different concentrations of the used catalyst mixtures of 1,4-diazabicyclo[2.2.2]octane, Iron(III) chloride as gelling catalysts and Bis[2-(N,N-dimethylamino)ethyl] ether as a blowing catalyst.

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