POLYCARBONATES 3D-PRINTED VIA HOT LITHOGRAPHY

Stephan Schandl[a], Katharina Ehrmann[a], Patrick Knaack[a],
Jürgen Stampfl[b], and Robert Liska[a]

[a] Institute of Applied Chemistry, Technische Universität Wien, Getreidemarkt 9, 1060 Vienna
[b] Institute of Materials Science and Engineering, Technische Universität Wien, Favoritenstrasse 9-11, 1040 Vienna

As additive manufacturing techniques are increasingly interesting for fast prototyping or production of complex geometries, more and better materials are needed. Laser-based 3D-printing produces parts with high resolution and high surface structure quality. A photopolymerizable resin is scanned layer by layer to generate a 3D structure. With operating temperatures of up to 120 °C, Hot Lithography enables processing of highly viscous and at room temperature moderately reactive formulations. Commonly used monomers for 3D-printing, such as (meth)acrylates, suffer from polymerization shrinkage causing low surface quality or cracks. Cyclic carbonates show volume expansion upon ring-opening polymerization and therefore eliminate said negative side effects. [1]

In this work, cyclic carbonates are investigated for potential application in Hot Lithography. Cyclic carbonates were synthesized and characterized. Photo-DSC and -rheology analysis were used to determine photo-reactivity at different temperatures. Conversion and molecular weight were determined by NMR- and GPC-analysis, respectively. Difunctional cyclic carbonates were designed and synthesized as crosslinkers and characterized in analogy to the monofunctional monomers. Finally, thermomechanical properties of the obtained materials were tested by tensile tests and DMTA measurements.

[1] Takata, T. and T. Endo, *Ionic polymerization of oxygen-containing bicyclic, spirocyclic, and related expandable monomers*. 1992: CRC Press: Boca Raton.