STRUCTURE-PROPERTY RELATIONSHIPS OF ADDITIVELY MANUFACTURED THIOL-CLICK VITRIMERS

Usman Shaukat, Elisabeth Rossegger, and Sandra Schlögl

Polymer Competence Center Leoben, Austria

With the recent developments in covalent adaptable networks, vitrimeric networks have gained increased attention as self-healable and recyclable materials. Additive manufacturing of vitrimers offers distinctive advantages towards the customized fabrication of complex structures with additional functionalities. In this work, thiol-ene systems with ample hydroxyl and ester moieties were photo-cured in the presence of an appropriate transesterification catalyst. At elevated temperature, dynamic exchange reactions of the hydroxyl ester groups were induced, which led to topological rearrangements and a macroscopic reflow of the photopolymer networks. In a comprehensive way, we studied the effect of crosslinking density, monomer structure and network architecture on the mechanical, thermal and vitrimeric properties of the dynamic photopolymers. In addition, the self-healing properties were determined as a function of network structure and vitrimeric properties. By appropriate network design we were able to control the glass transition temperature and the topological freezing temperature of the networks over a wide range. The results revealed that a high mobility of the polymer chains together with a high catalyst content is beneficial for inducing fast exchange reactions well below 100 °C. This paves the way towards 3D printable vitrimer systems, which can be healed under mild conditions.