# HIGHLY FILLED HYDROGELS AS BIOCOMPOSITES AND CERAMIC PRECURSORS FOR 3D PRINTING APPLICATIONS

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Hydrogels form a crosslinked 3D polymer network and have the possibility to absorb high amounts of water. For applications in the biomedical field hydrogels are a promising material platform in combination with lithography-based additive manufacturing technologies (L-AMT, type of 3D printing). On the other hand, water borne ceramic precursors are an interesting, environmentally friendly alternative to solvent borne formulations. The most common materials for L-AMT are acrylate monomers, because of their high reactivity and commercial availability. However, for biocompatible hydrogels acrylate monomers were replaced by vinyl esters owing their lower cytotoxicity. In this work, new monomers were synthesized from commercial available divinyl adipate (DVA) by lipase catalyzed transesterification reactions. In order to improve reactivity of the new polyethylene glycol based vinyl ester monomers thiol-ene chemistry was employed [1]. Different acrylate and vinyl ester precursors were printed by digital light processing (DLP) based stereolithography (DLP-SLT) [2]. With this technique it is possible to print geometric demanding structures, as shown in Figure 1. For the printing process of highly filled hydrogels Lithography-based Ceramic Manufacturing (LCM) was applied. Materials for different applications scenarios, for example ceramic precursors (for dense zirconia ceramic parts) or hydroxyl apatite filled biocomposites (biomaterial for bone regeneration), could be fabricated by means of LCM.

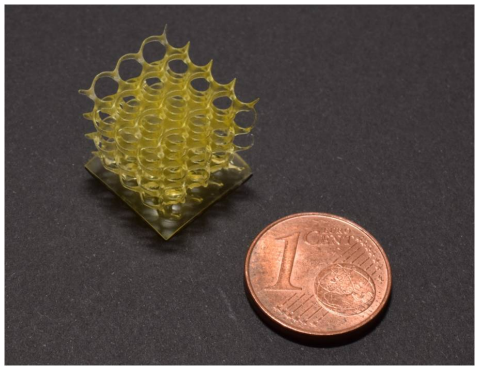

**Figure 1: 3D-printed hydrogel scaffold**

[1] Mautner A., Qin X.H., Wutzel H., Ligon S.C., Kapeller B., Moser D., Russmueller G., Stampfl J. and Liska R.: J. Polym Sci., Part A: Polym. Chem. *51*, 203 (2013).

[2] Schwentenwein M., Schneider P., Homa J.: Adv. Sci. Tech. *88*, 60 (2014).