DEVELOPMENT OF CURING AND FOAMING PROCEDURE FOR CORE-SHELL-PARTICLE ENHANCED FOAMABLE INKS IN POLYJET PRINTING

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Printing of foamable inks with PolyJet technology opens a promising way to produce light-weight three dimensional objects. In PolyJet printing, liquid photopolymer droplets are jetted, which are UV-cured immediately afterwards, building up a 3D object layer by layer. To date, 3D printing of foams requires several working steps, like fused filament fabrication and subsequent leaching in water yielding soft foams [1]. In contrast, printing foamable inks with PolyJet is a novel approach enabling the fabrication of pressure-stable foams in one step. The foamable ink is produced by suspending core-shell-particles (CSP) in a proper acrylate matrix. The CSP consist of a blowing agent (BA) surrounded by a polymeric shell [2]. Foaming starts after heat input, e.g. near-infrared irradiation, expanding the CSP through boiling of the BA. To yield a stable foam, the acrylate matrix is UV-cured immediately afterwards, stabilizing the expanded CSP (Figure 1). Development of a suitable curing and foaming strategy is a crucial part in this process to achieve optimum desired properties of the final printed object, including high weight reduction and stable foam structure. This study includes curing kinetics of the matrix as well as selection of parameters for foaming. The curing progress is monitored via FTIR and foam structure is characterized via optical microscopy (Figure 2).

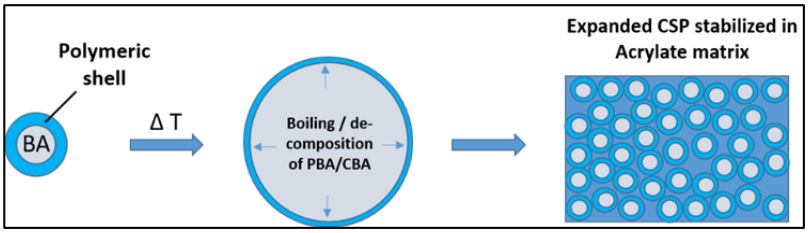

Figure 1: Expansion of CSP through heat input.

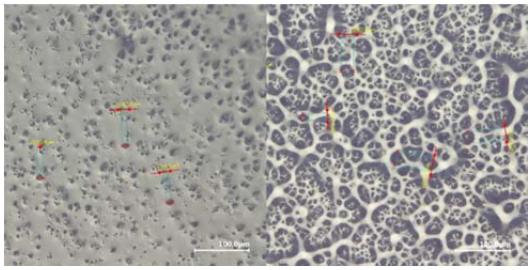

Figure 2: cured CSP-ink (left) and both foamed and cured CSP-ink with pore structure (right).

[1] M. Molitch-Hou, “Kai Parthy Gets Felty, Foamy and Porous with PORO-LAY Line of Filaments” (https://3dprintingindustry.com/news/kai-parthy-gets-felty-foamy-porous-poro-lay-line-filaments-21636/, accessed 20.04.2017)

[2] M. Jonsson, O. Nordin, E. Malmström, C. Hammer, *Polymer*, 2006, **47,** 3315–3324