HOT LITHOGRAPHY – SETTING THE STAGE FOR HIGH PERFORMANCE PHOTOPOLYMERS IN 3D-PRINTING

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Additive manufacturing technologies, or 3D-printing, are rapidly gaining relevance as production solutions for industrial applications by enabling freedom of design, individual customization, and on-demand fabrication. The need for short product cycles and rapid innovation in key markets such as medical, consumer goods, mobility and electronics industry further drive additive manufacturing with lithography-based additive manufacturing technologies (L-AMTs) being the methods of choice when it comes to the design of complex shapes with high resolution (down to 10 µm) and exceptional surface quality (R_z < 10 µm).

However, those L-AMTs historically feed on a material palette, which was originally designed for coatings and other thin layer applications. Forming bulk materials from such resin systems typically yields brittle materials with low toughness. This inherently created the need for extensive process and material development to enable the precise 3D-fabrication of functional parts for technical applications.

The Hot Lithography technology developed by Cubicure GmbH enables reliable processing of light-curable, viscous formulations (up to 20 Pa s) at elevated temperatures (up to 120 °C). With this expanded window of opportunity for material development, an extended library of promising key components is now accessible to tune the final material performance of photopolymer systems in 3D-printing. Such key components could exhibit optimized molecular weight (*e.g.*, elastomeric polyester resin developed in collaboration with Evonik), high melting temperatures (*e.g.*, high-temperature- and flame-resistant material ThermoBlast), strong intermolecular forces (*e.g.*, urethanes, ureas, carbonates), new reactive groups (*e.g.*, chain transfer reagents[1], oxazolines[2]) or high contents of functional fillers (*e.g.*, ceramic [3], metal or polymer fillers).

[1] Grunenberg, D.; Ehrmann, K.; Gorsche, C.; Steyrer, B.; Koch, T.; Stampfl, J.; Liska, R.; Polymer Chemistry 2021, 12, 1260-1272.

[2] Klikovits, N.; Sinawehl, L.; Knaack, P.; Koch, T.; Stampfl, J.; Gorsche, C.; Liska, R.; ACS Macro Letters 2020, 9, 546-551.

[3] Rath, T.; Martl, O.; Steyrer, B.; Seidler, K.; Addison, R.; Holzhausen, E.; Stampfl, J.; Applied Materials Today, 2021, 23, 101016.