Printing Photopolymers by Hot Lithography

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Abstract:

Lithography-based additive manufacturing (L-AM) is used for printing very precise and accurate parts from photopolymer resins. Conventional L-AM printers are curing resins with low viscosity at or slightly above room temperature. The newly developed Hot Lithography provides L-AM where the resin is heated and cured at elevated temperatures.

The increased printing temperature provides several benefits and opens opportunities for printing high-viscosity photopolymers. Higher printing temperature reduces the critical energy E_0 of the resin. This leads to reduced light exposure time per layer and a faster printing process. Furthermore, the printed green parts show higher conversion and better mechanical properties when printed at a higher temperature. This helps for cleaning and post-processing of the printed parts. After post-curing, there is no significant difference in conversion and mechanical properties.

Resins with higher molecular weight show various benefits in their final mechanical properties. However, these resins show high viscosity or can even be solid at room temperature and are not printable by conventional L-AM. An increase in temperature reduces the viscosity to allow processing of such resins with the well-known precision of L-AM. Functional parts with over 60 MPa tensile strength, 20 % elongation at break, and 120 °C glass transition temperature have been successfully printed.

Keywords: Hot Lithography, Additive manufacturing; Stereolithography; Photopolymer, Temperature