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Accelerating photo-ROMP for use in Additive Manufacturing

Samuel Leguizamon*, Jefferey Foster, Adam Cook, Leah Appelhans
Sandia National Laboratories, Albuquerque, NM 87123
*sleguiz@sandia.gov

The additive manufacturing (AM) of thermoset polymers has been limited primarily to radical or cationic photopolymerizations, restricting available resins and attainable material properties. Recent efforts in the AM of polydicyclopentadiene (pDCPD) via ring-opening metathesis polymerization (ROMP) have resulted in printable thermoset materials with advantageous high-performance properties. However, previous demonstrations of DCPD ROMP for AM have been hindered by sluggish printing rates and there is limited characterization of the printed materials. Here, we will present the use of a novel photo-latent metathesis-active resin system for the 3D printing of tough, high-performance pDCPD thermosets though both UV-assisted direct-ink write (DW) AM and stereolithography (SLA) AM. Notably, continuous SLA AM is achieved by employing a photo-base generator to yield a catalyst deactivation layer adjacent to the projection window. With the use of the resin system described, DIW and continuous-SLA printing rates of 60 $mm \cdot s^{-1}$ and 180 $mm\ h^{-1}$ are demonstrated.

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