APPROACHES TO THERMOSET RESINS FOR DIRECT-INK-WRITE ADDITIVE MANUFACTURING

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Polymer thermosets, which crosslink irreversibly, often have better strength, stability and environmental resilience than polymer thermoplastics, which contributes to the broad application of thermosets in electronics, structural materials, coatings and adhesives. However, additive manufacturing approaches for thermosets are still a developing field, with a limited number of commercially available printers and resins primarily targeted to stereolithography (SLA) printing. Interest in the development of direct-ink-write (DIW) methods for thermoset resins has increased significantly in the last several years. Approaches generally fall into two categories. Filled thermoset resins achieve the necessary rheological properties for printing by incorporation of moderate loadings of particles or fibers. Dual-cure resins are typically two-component resins which employ an *in situ*-curable component, to maintain the shape and structure of the printed article, followed by a final cure to crosslink the second resin component and impart improved mechanical, thermal, and chemical stability. This presentation will describe the development and optimization of a DIW dual-cure thermoset resin and the impacts of different component compositions on the printability, ‘green strength’, and final mechanical and thermal properties of the resins. The formation and evolution of interpenetrating polymer networks in dual-cure epoxy/acrylate formulations and initial studies on the impact of functionalized filler particles as network crosslinkers are described. Finally, the impact of acrylate functionality on green strength, acrylate network cure kinetics, and final properties will be reported.

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