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Formulation, Cure Kinetics, and Performance of Vinyl Ester Photolithography Resins for Digital Light Processing

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The expansion of additive manufacturing (AM) technology is currently limited by the poor performance characteristics of existing materials. Available photocurable acrylate-based resins often to do achieve sufficient properties required for engineering materials or end-use products. Moreover, the proprietary formulations of these systems are not conducive to systematic study. Photocurable vinyl ester (VE) resins containing various reactive diluents (RDs) are investigated in this work to address these challenges. VE resins are renowned for their low viscosity, rapid rates of cure, and high thermomechanical performance characteristics. It was found that the processability, printability, copolymerization kinetics, thermal properties, and mechanical performance of printed VE thermosets were highly reliant on the type of RD that was used. DMA experiments revealed the T_g of these systems remained well over 100 °C. Additionally, room temperature storage and flexural moduli were measured to be above 2 GPa for all printed materials, which are desirable characteristics for high performance thermosets. Based on the results of these experiments, *para*-methyl styrene was determined to be the most effective RD for future consideration in VE photolithography resin systems.