High-performance materials for mask-projection stereolithography via *in-situ* sequential interpenetrating network

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Additive manufacturing has gained great popularity in recent years due to its advantages over traditional manufacturing methods such as design freedom, customization, waste reduction, and low cost. Stereolithography is one of the most popular techniques used in additive manufacturing as it offers high dimensional accuracy. However, there are limited materials that can be used for this process as the resins need to be photocurable. Acrylates and epoxies are commonly used, but their thermal and mechanical properties are not suitable for applications in which high-temperature performance is needed. High-performance materials such as bismaleimide and cyanate ester are traditionally cured by thermal processing. In order to utilize these materials in stereolithography, we developed a photocurable resin containing bismaleimide and cyanate ester that provides outstanding thermal and mechanical characteristics. In this system, an in-situ sequential interpenetrating network (IPN) is formed wherein bismaleimide and a reactive diluent copolymerize during printing resulting in cyanate ester swollen network with a sub room temperature T_g. During a second step, the cyanate ester is thermally cured. The IPNs are expected to have lower density change during cure reaction, improved interlayer strength, and improved toughness relative to standard systems.