Abstract Submitted
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In-situ curing of liquid epoxy via gold-nanoparticle mediated photothermal heating[1] GABRIEL FIRESTONE, JU DONG, JASON BOCHINSKI, RUSSELL GORGA[2], LAURA CLARKE[3], North Carolina State Univ — The ability to selectively alter material properties in-situ is important for many biological applications where an initially flexible part (needed for ease of placement) would ideally be rigidified once in position (for instance, within a broken bone as a tissue scaffold). Thermoset epoxies harden from viscous liquids into solid materials when heated. In this work, metal nanoparticle-epoxy-hardener composites are formed and utilized to enable in-situ crosslinking by drawing a pattern on a shallow bath of liquid epoxy with a laser. This approach capitalizes on the phothothermal effect of metal nanoparticles where irradiation with light resonant with the nanoparticle surface plasmon resonance leads to dramatic local heating. We discuss challenges to incorporating metal particles into epoxy-hardener, observation of changes in the heat profile within the epoxy due to the intensity and rastering speed of the laser, and show that the mechanical properties of internally cured epoxy are the same as those cured conventionally. The ability to selectively fabricate a part from a liquid (with no mold or waste) may be an important alternative manufacturing approach.

[1]National Science Foundation CMMI-1069108
[2]Dept. of Textile Engineering, Chemistry, and Science
[3]Dept. of Physics

Gabriel Firestone
North Carolina State Univ

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