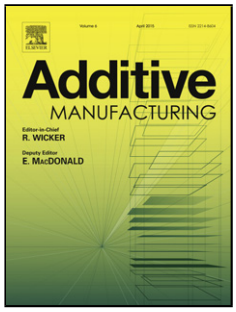

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Multiple modulus silicone elastomers using 3D extrusion printing of low viscosity inks

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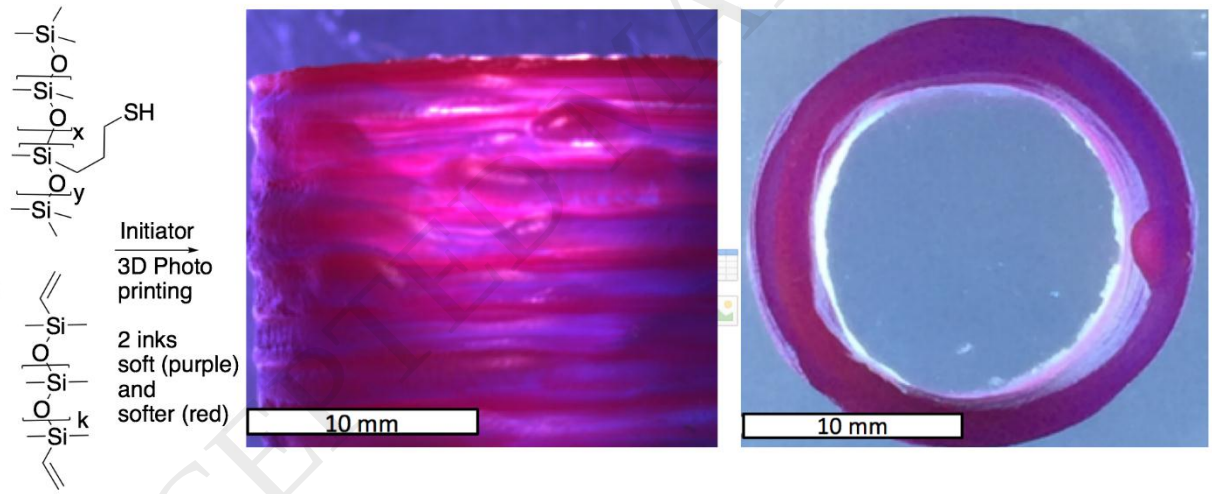
Graphical Abstract



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Abstract

Silicone elastomers are of commercial interest in a number of areas because of their distinctive properties. Current 3D-printing (additive manufacturing) technologies for silicones mainly rely on the extrusion of high-viscosity pre-elastomer inks of one or two parts. Some of the challenges presented by high viscosity materials, for instance, difficulties in mixing and changing inks to create devices from more than one type of silicone, could be overcome by use of lower viscosity inks. Here we describe a family of rapidly curing (shape holding within <2s, full cure in <20 s), readily mixed, low-viscosity silicone inks using a combination of chain-extender, cross-linker, base polymer and photoinduced thiol-ene click chemistry. A key advantage of low viscosity is the facility to mix or change ink constituents, which facilitates changing inks, and the properties of the resulting cured materials. Microfluidic printheads and pneumatic control systems that switch rapidly between multiple inks, and then cure them using a UV exposure system, are also described. The combination of fast curing inks, and the printhead that extrudes and then cures them, allows 3D extrusion printing of low-viscosity silicone materials without the use of supporting material. The ability to print overhanging

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