SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Highly Stretchable Elastomer for 3D Printing

Background

Most widely used silicon rubber-based elastomers require a thermal curing process which significantly limits its fabrication in traditional ways, such as by cutting, molding and casting, which constrains design freedom and geometric complexity. In order to enrich the design and fabrication flexibility, researchers attempted to use 3D printing techniques, such as the ultraviolet (UV) curing based 3D printing techniques that solidify liquid polymer resins to 3D objects through patterned UV light, to fabricate elastomeric 3D objects. Nevertheless, most of the commercially available UV curable thus 3D printable elastomers break at less than 200% (two times the original length), which makes it unsuitable for many applications

Technological Solution

A family of highly stretchable and UV curable (SUV) elastomers was developed that can be stretched by up to 1100%, which is more than five times the elongation at break of any commercially available elastomer that is suitable for UV curing based 3D printing techniques. Using high resolution 3D printing with the SUV elastomer compositions enables the direct creation of complex 3D lattices or hollow structures that exhibit extremely large deformation. The new SUV elastomers could lead to directly print complicated geometric structures and devices such as a 3D soft robotic gripper within an hour. Compared to traditional molding and casting methods, using UV curing based 3D printing with the SUV elastomers significantly reduces the fabrication time from many hours, even days, to a few minutes or hours as the complicated and time-consuming fabrication steps such as mold-building, molding/demolding, and part assembly are replaced by a single 3D printing step.

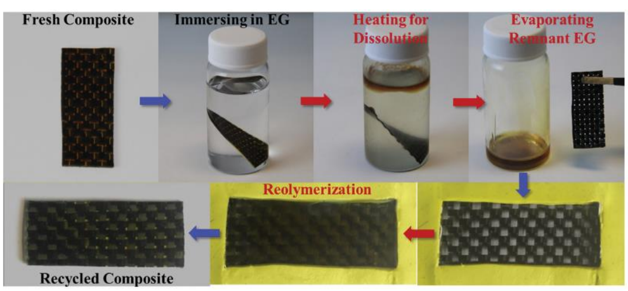
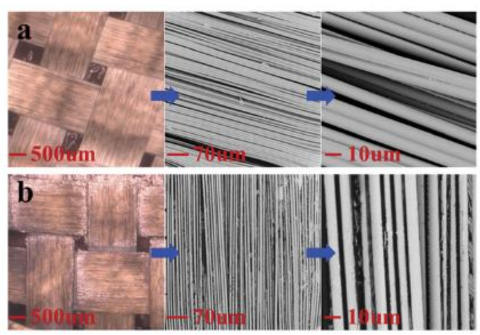


Fig. 1: Experimental pictures

Fig. 2: SEM images



Value Preposition

The SUV elastomers, together with the UV curing based 3D printing techniques, will significantly enhance the capability of fabricating soft and deformable 3D structures and devices including soft actuators and robots, flexible electronics, acoustic metamaterials, and many other applications. The SUV elastomers not only sustain large elastic deformation, but also maintain good mechanical repeatability, which makes them good materials for fabricating flexible electronics

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