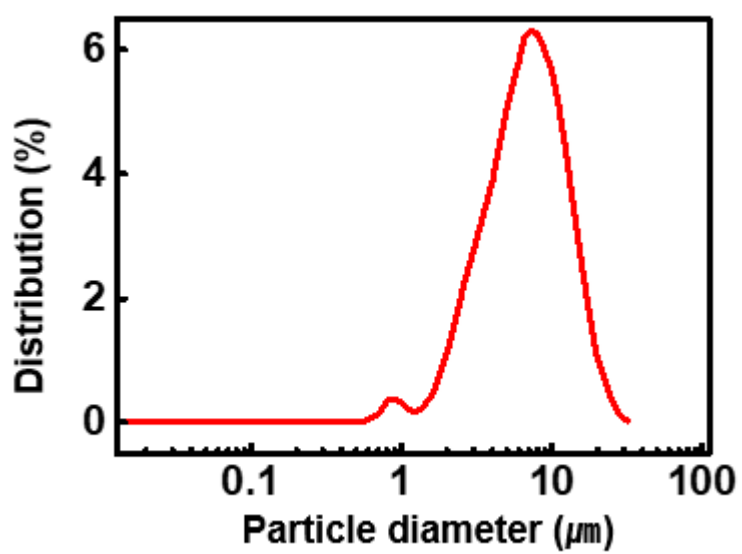
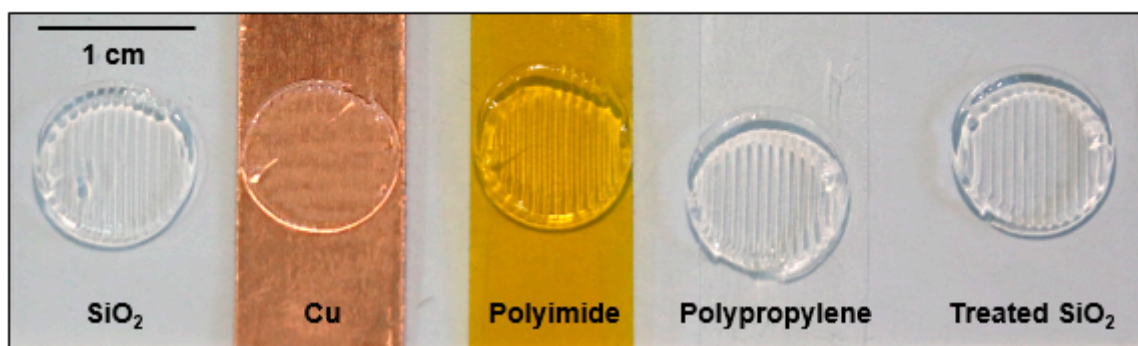


Figure S1. Particle size distribution of Ag flakes. Particle size distribution displayed in volume weighted version.



**Figure S2. Adhesion test of sRTV to various substrates. Substrates are glass, Cu tape, polyimide tape, polypropylene tape, release agent treated glass from left to right. Diameter of 1 cm circle is printed on each substrate (a) Right after printing (b) Left surface after peel-off**

**a**



**b**

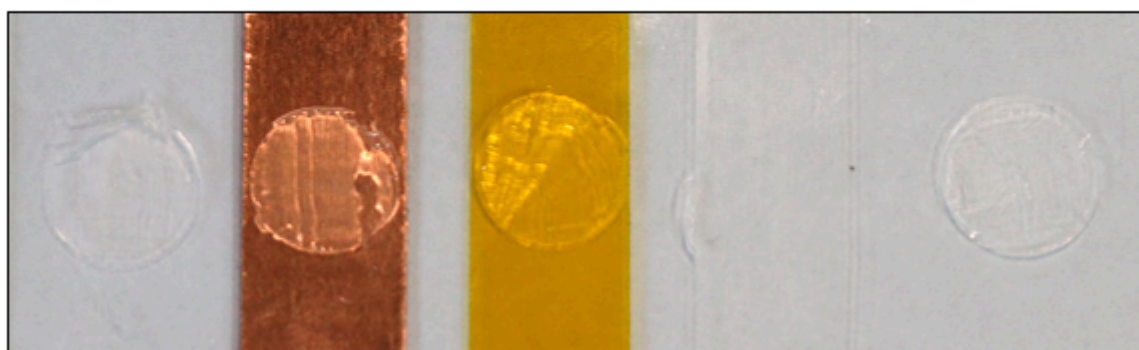
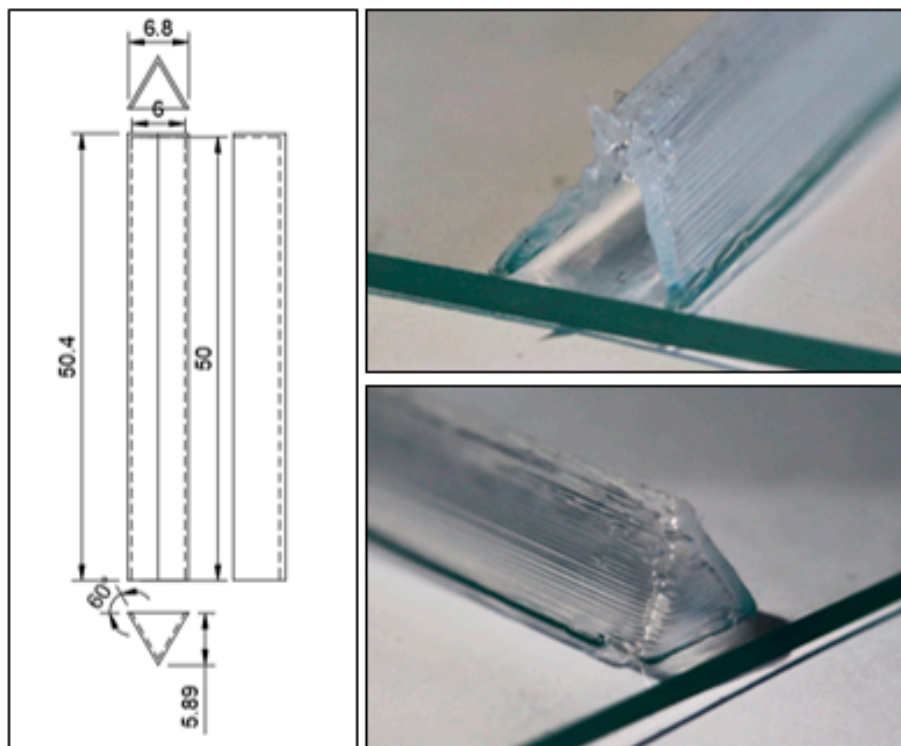


Figure S3. Various 3D structure printed with sRTV as frame materials. (a) Triangular horizontal 1 channel (b) Hexagonal vertical 3 channel

**a**



**b**

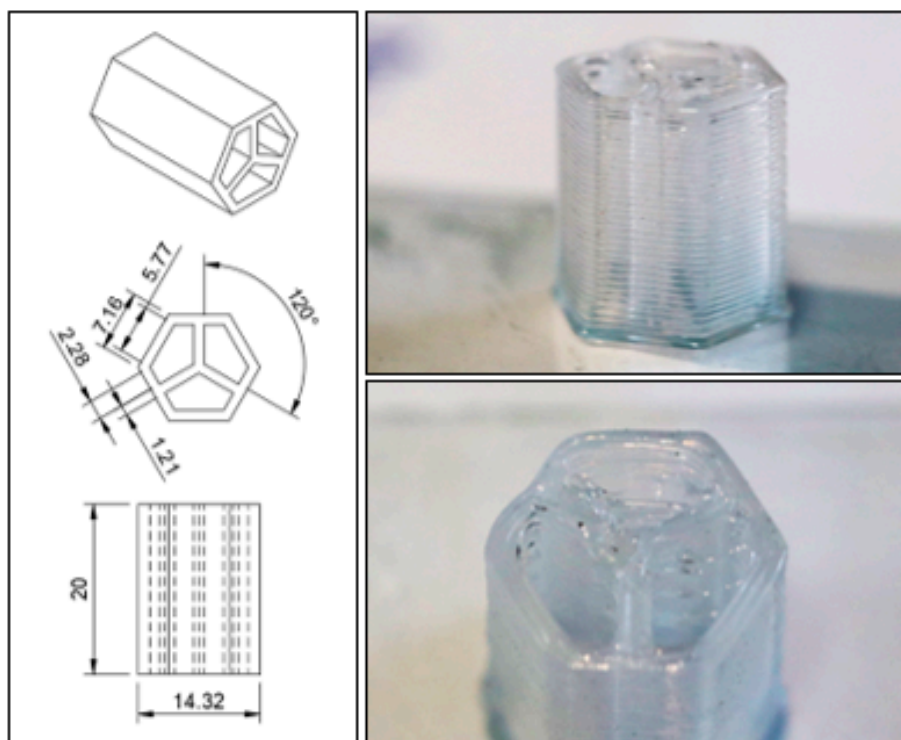


Figure S4. Rheological properties and 3D printability of rRTV. (a) Shear modulus change by shear stress (b) Viscosity change by shear rate (c) 1 cm diameter and 5 mm height scaffolds with grid pattern with rRTV

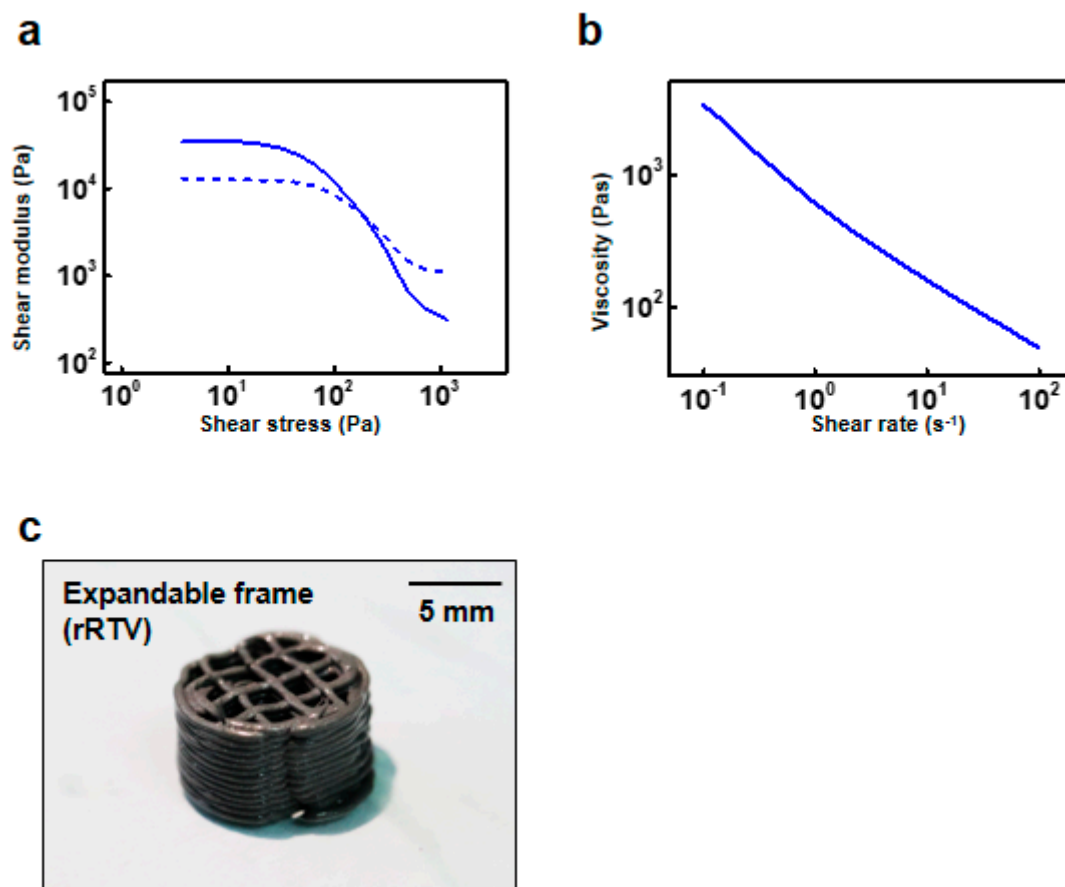


Figure S5. Stress-Strain curve of rRTV.

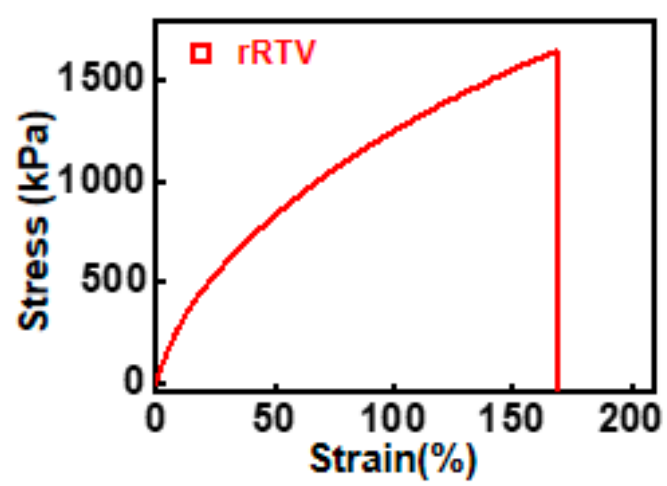


Figure S6. Resistance change of Ag-RTV in various environments. (Black, HCL 20 % ; Red, H<sub>2</sub>SO<sub>4</sub> 20 %; Blue, NaOH 20 %; Margenta, PBS 1X)

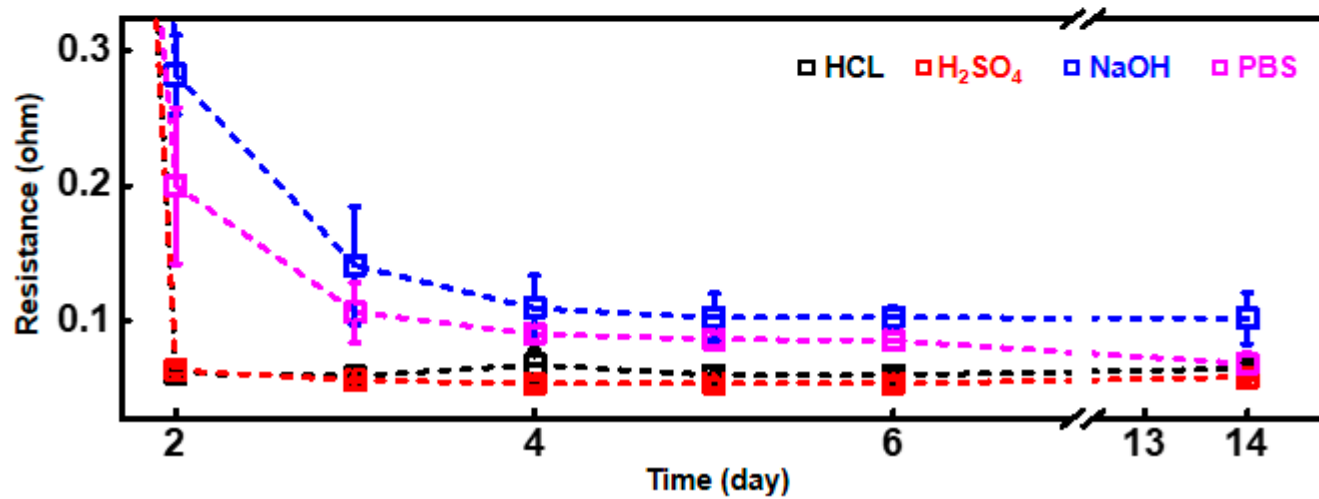
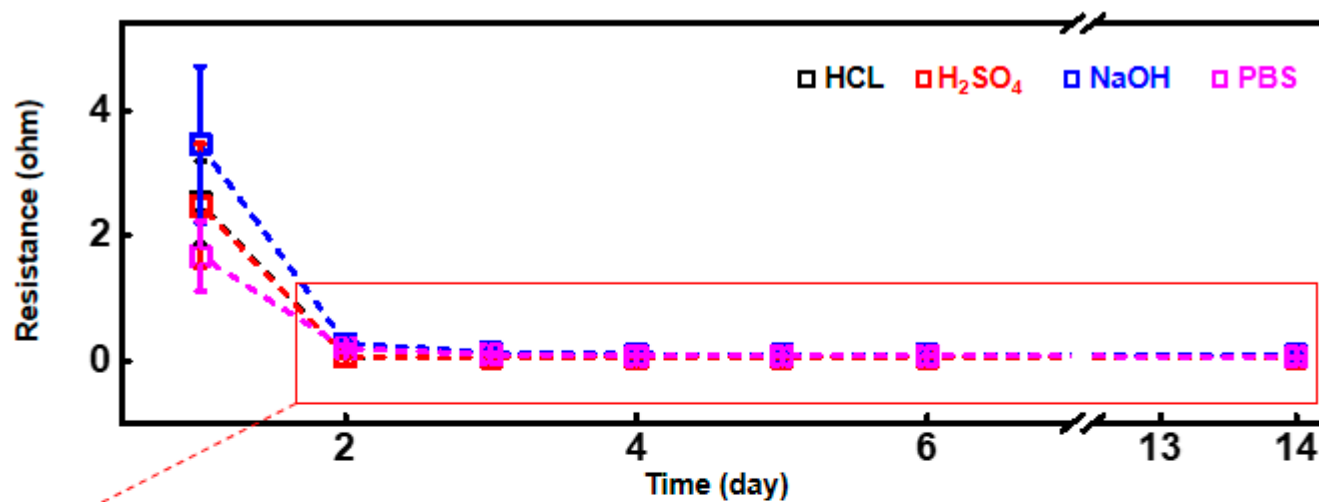
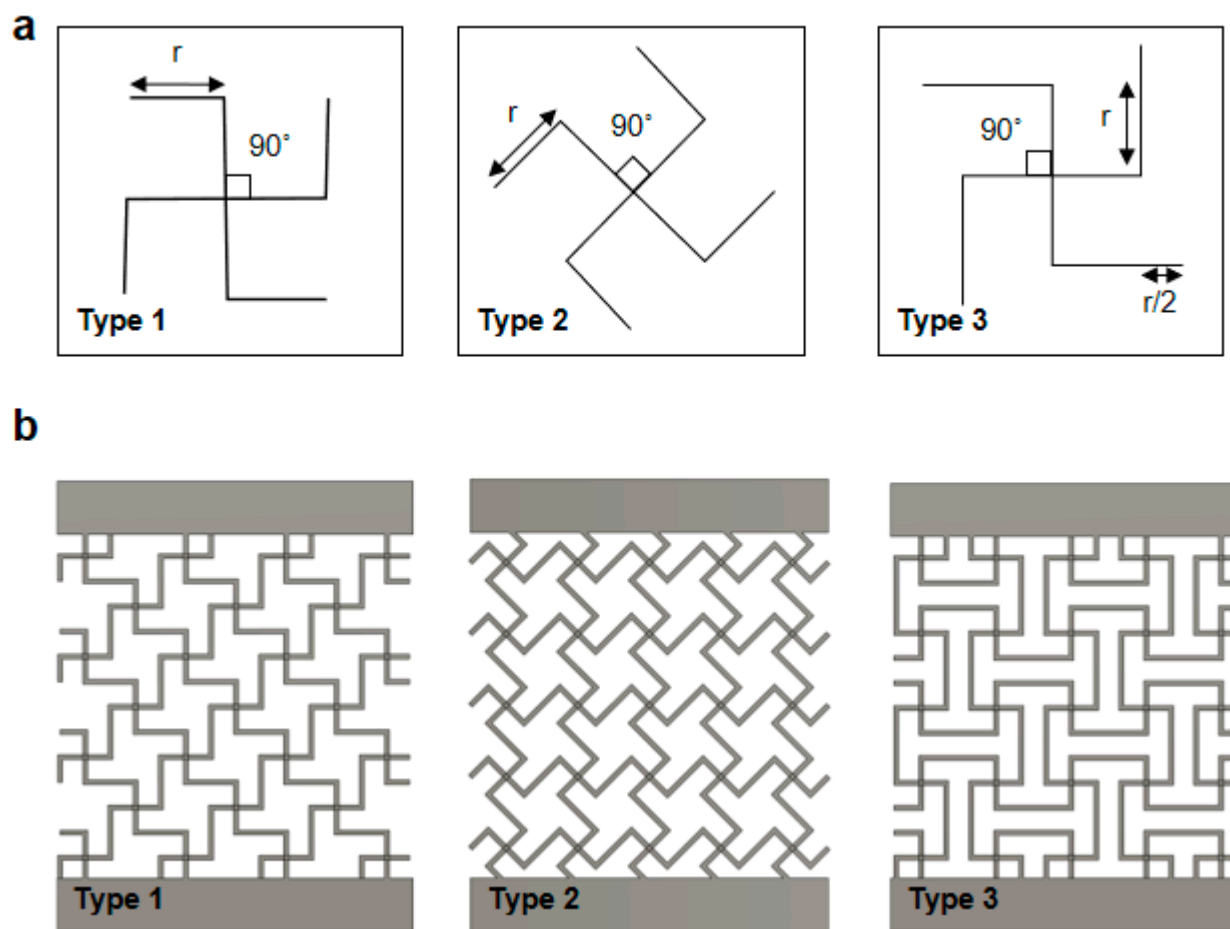
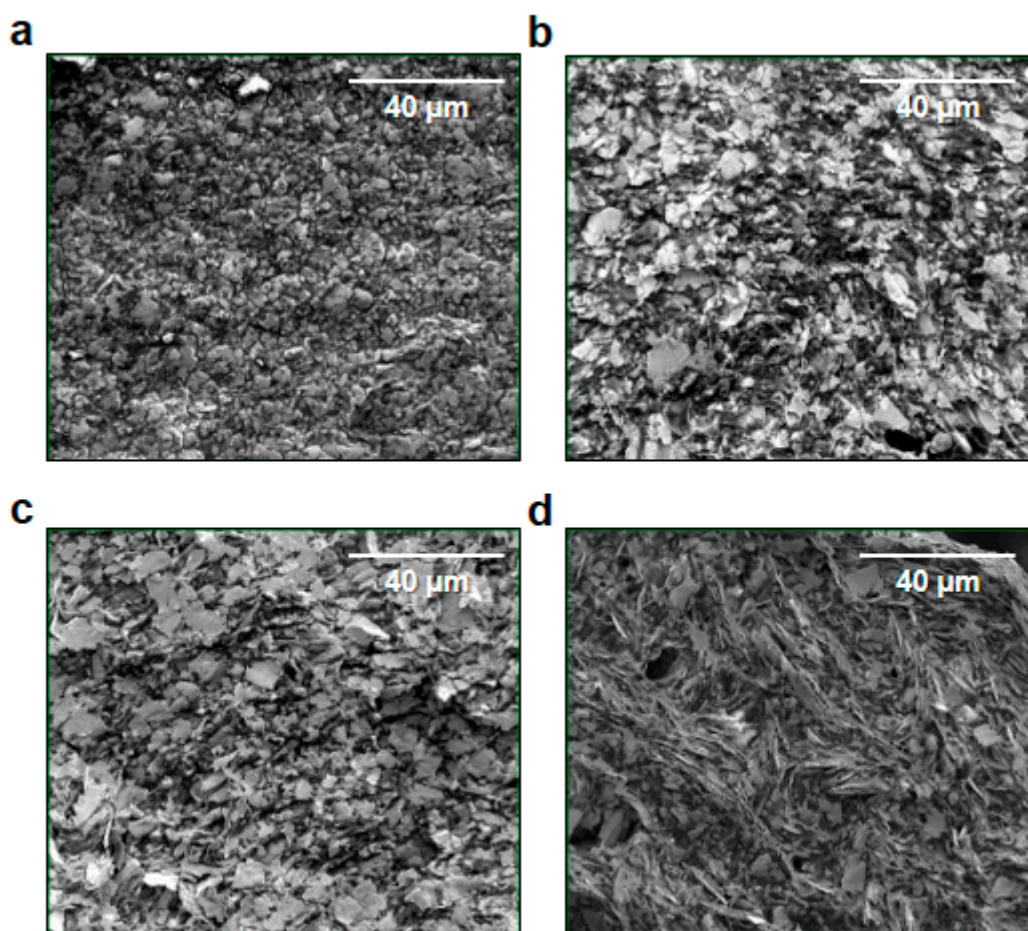


Figure S7. Dimension of auxetic structured substrate. (a) Unit cell of missing rib structures where  $r = 2.121$  mm, width of line = 0.4 mm (b) Three types of auxetic pattern for tensile test sample where height is 29 mm and width is 30 mm.

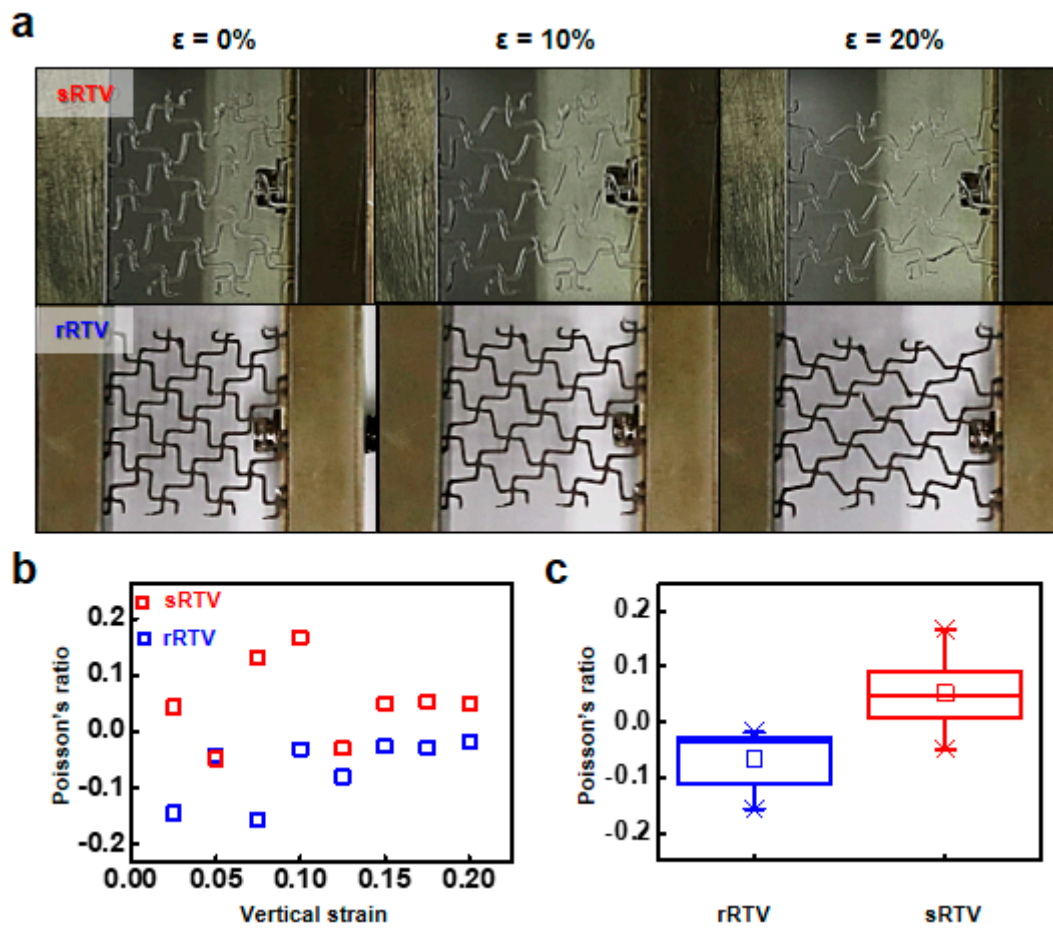


**Figure S8. SEM images of Ag-RTV trace morphology before and after uniaxial tensile test. (a) top view and (b) cross section view of Ag-RTV trace before stress applied and (c) top view and (d) cross section view of Ag-RTV trace after mechanical failure.**

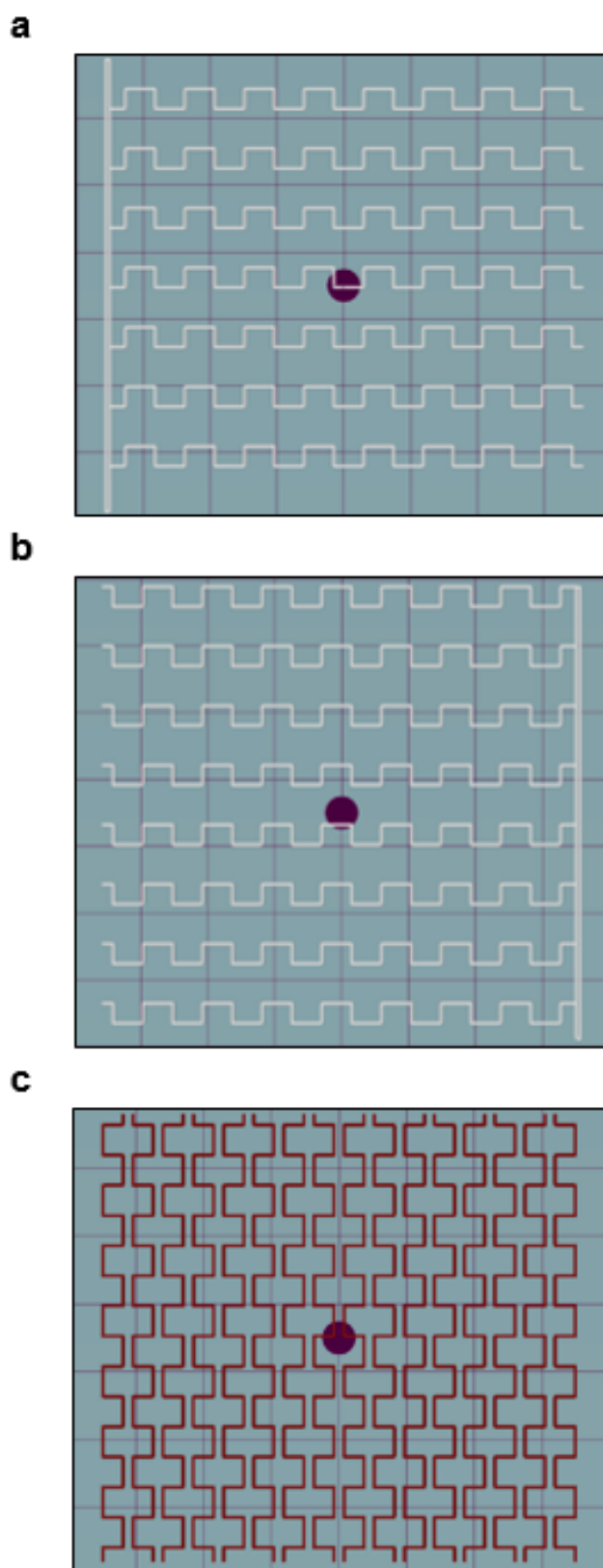




**Figure S9. Poisson's ratio calculation with sRTV and rRTV. (a) Serial images of type 1 missing rib arrays with sRTV and rRTV in strain 0 %, 10 %, 20 % (b) Strain dependent Poisson's ratio with sRTV and rRTV (c) Box chart of Poisson's ratio ranges for sRTV and rRTV for strain 2.5 % to 20 %. Box ranges from 25 to 75 %, - for max / min, × for 99 % / 1 %, □ for mean value.**

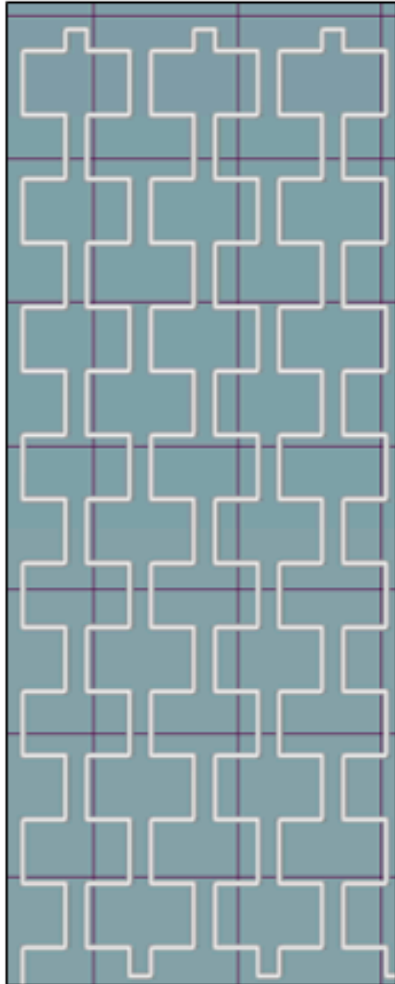


**Figure S10. G-codes for capacitive strain sensor in missing rib structure with Ag-RTV, rRTV.**  
(a) Capacitor electrode 1 (b) Capacitor electrode 2 (c) Control frame



**Figure S11. G-codes for resistive heater in missing rib structure with Ag-RTV and rRTV. (a) Resistor (b) Control frame**

**a**



**b**

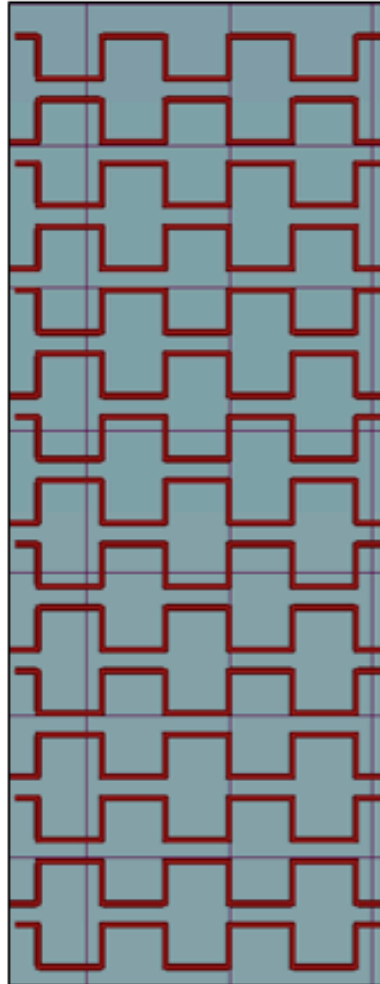


Figure S12. Setup for electromechanical properties measurements.

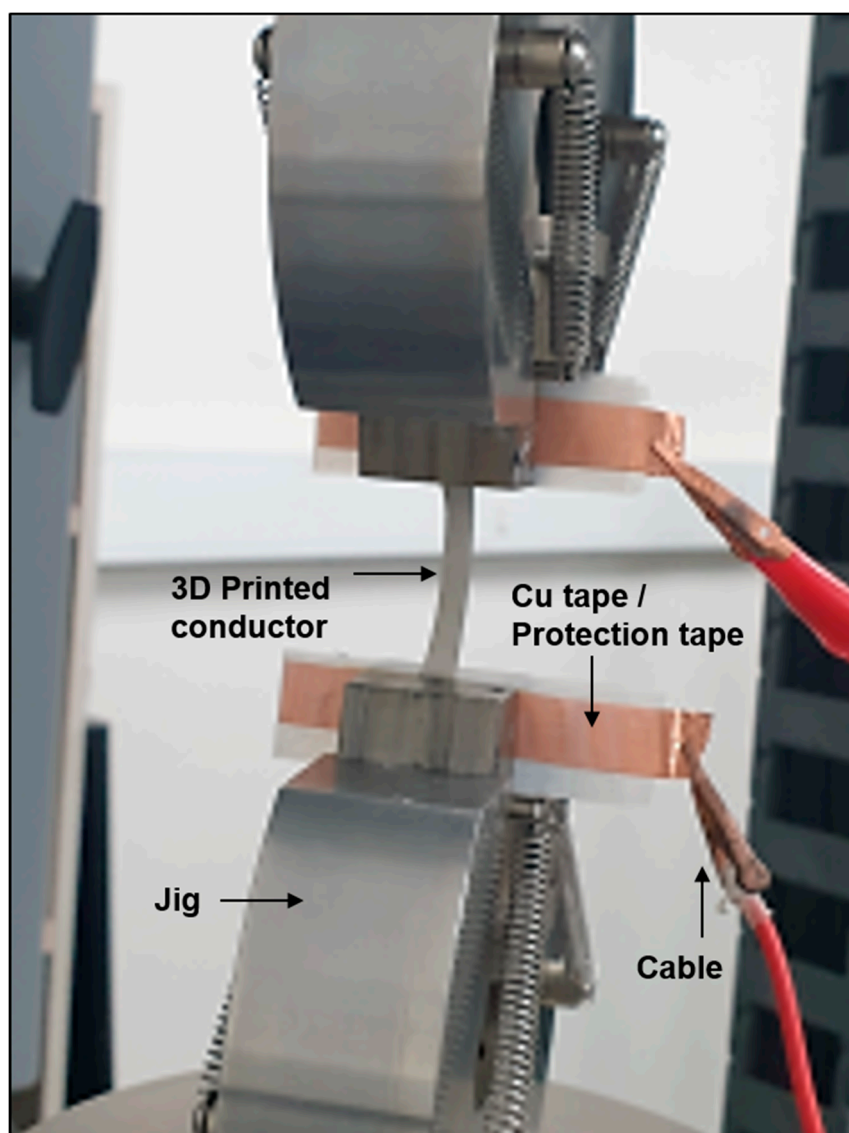


Figure S13. Expandable structure effects on resistance of Ag-RTV in strain change 0 % to 25 %.

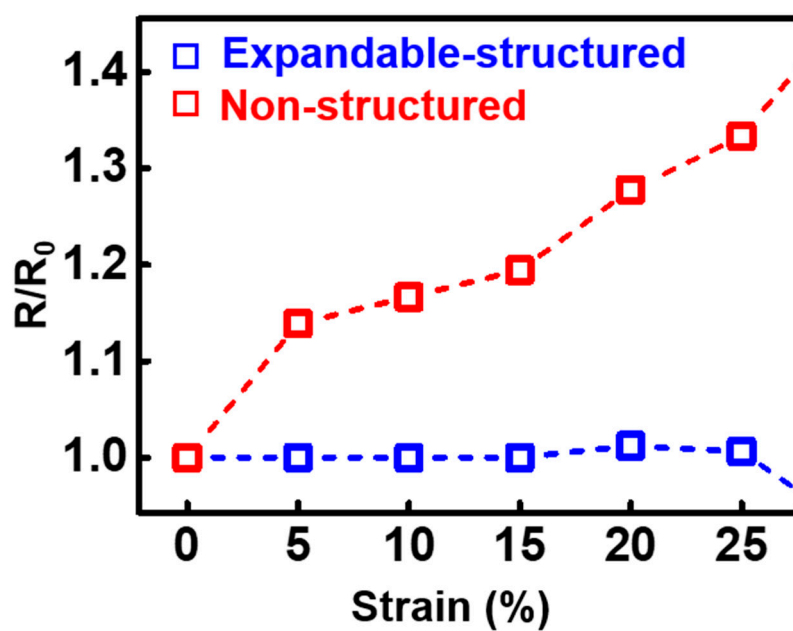
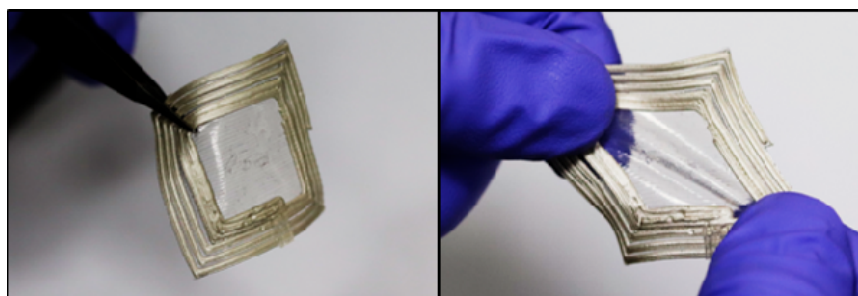


Figure S14. 3D printed stretchable inductor (a) Image of printed inductor (Ag-RTV/sRTV) (b) Inductance and quality factor of 3D printed inductor by frequency.

**a**



**b**

