Supporting Information for

Composites formed from thermoresponsive polymers and conductive nanowires for transient electronic systems

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Figure S1 shows the fabrication process used to pattern AgNW networks. 1. Deposit parylene onto Si wafer. 2. Use photolithography to pattern desired shape in resist. 3. Remove exposed parylene film using oxygen plasma. 4. Cast AgNW suspension on the whole wafer surface. 5. Peel the parylene off and leave patterned AgNWs on the surface. 6. Spin coat methyl cellulose solution. 7. Gently peel methyl cellulose film from Si substrate.

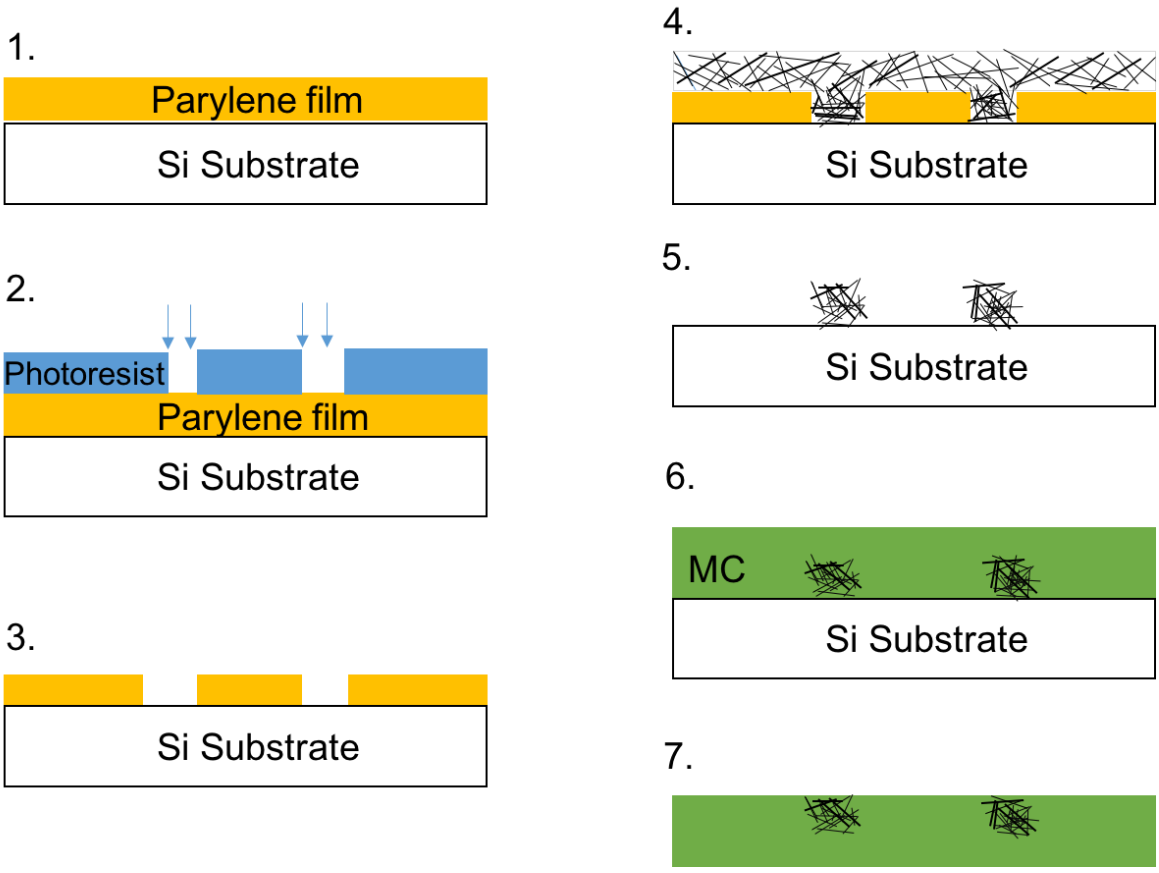

Figure S1. Schematic of fabrication process used to form conductive AgNW traces embedded in methyl cellulose film.

(a)

(b)

(c)

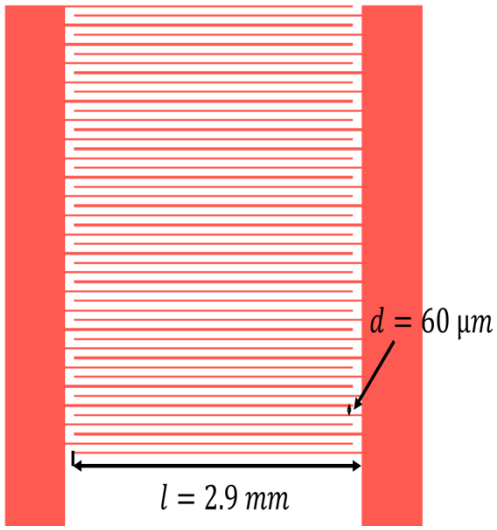

Figure S2. Optical image of interdigitated gold electrodes with deposition of 10 nm Cr and 100 nm Au fabricated on Si/SiO_2 (100nm thick) (a) and 5% AgNW/PNIPAm spin coated on the top surface (b). (c) Illustration of the electrode geometry (compound covered area in (b)).

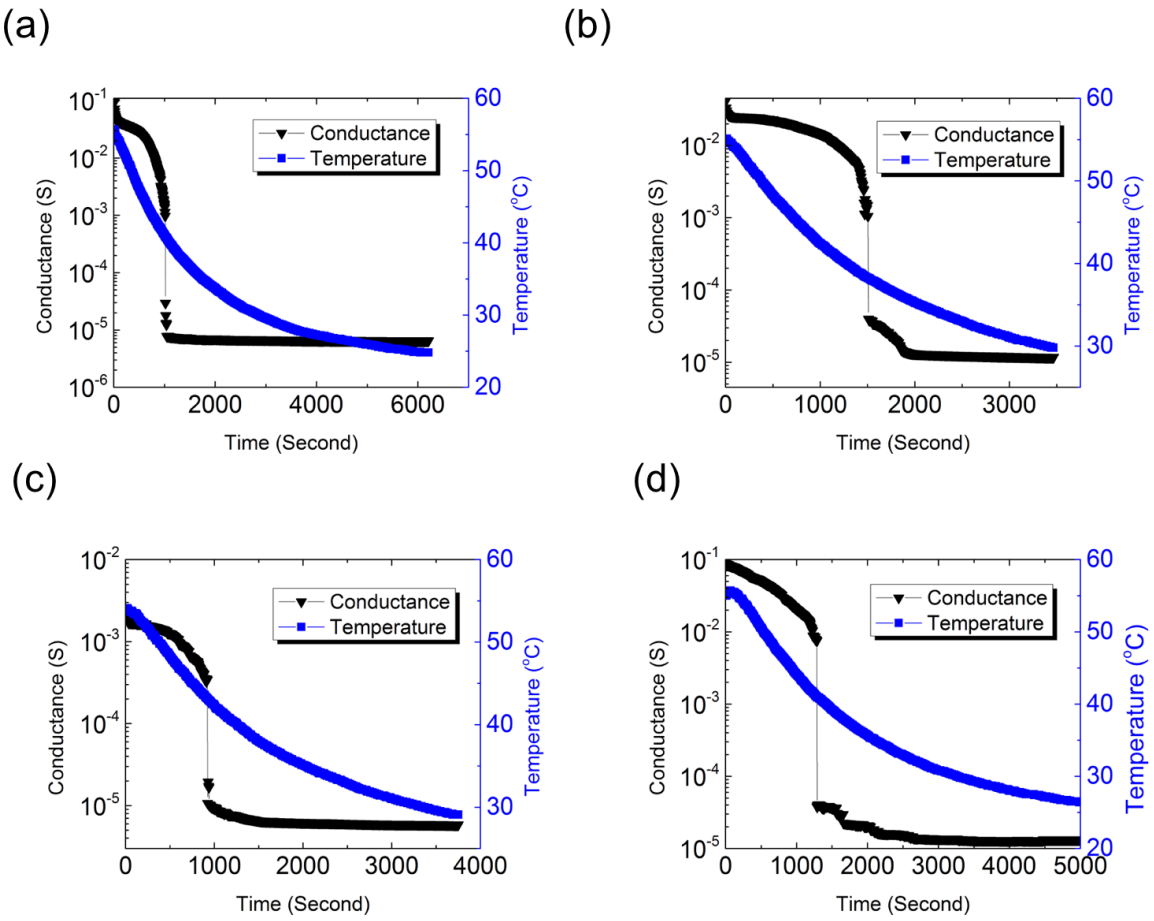

Figure S3. Electrical conductance of an immersed transient circuit (50mm in length and 4 mm in width), and water bath temperature after the bath heater is turned off. Measurements were taken every 5 seconds. Transient behavior of methyl cellulose film (0.08 mm in thickness, containing an embedded AgNW network) with molecular weight of 88,000(a), 41,000(b) and 14,000(c). (d) shows the transient behavior of 0.7 mm thick MC film with the same molecular weight as (b) but almost 10x thicker.

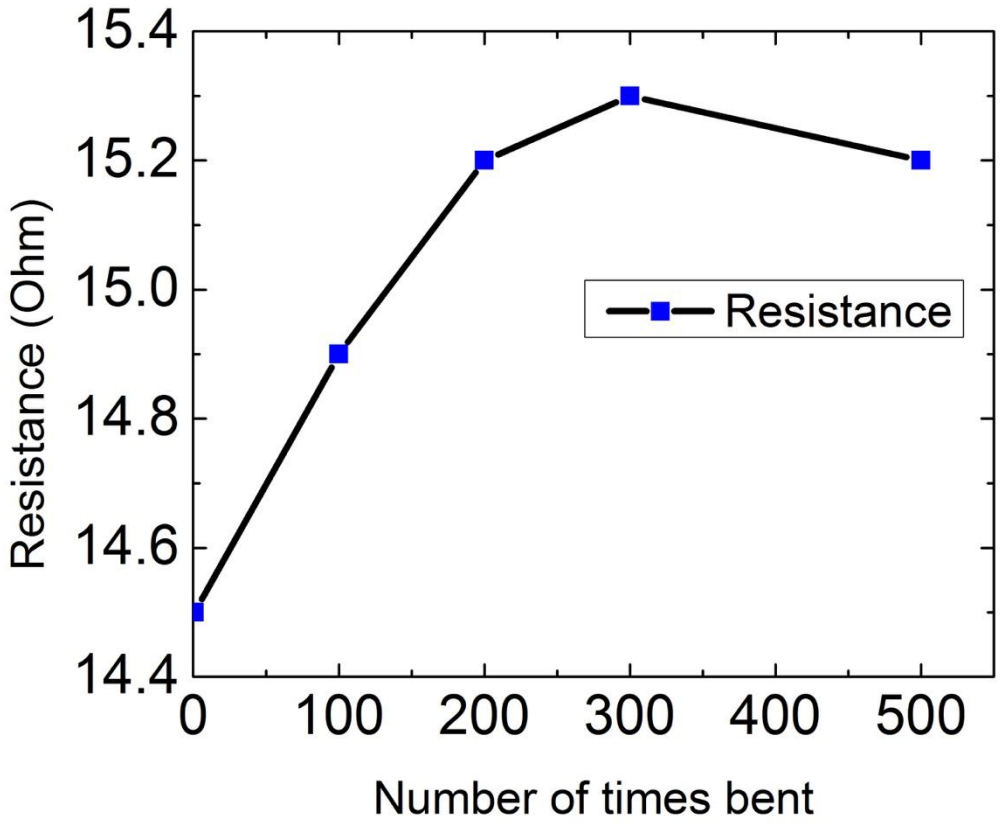

Figure S4. The electrical resistance of a AgNM/MC film after being deformed 180° by hand versus number of times bent.

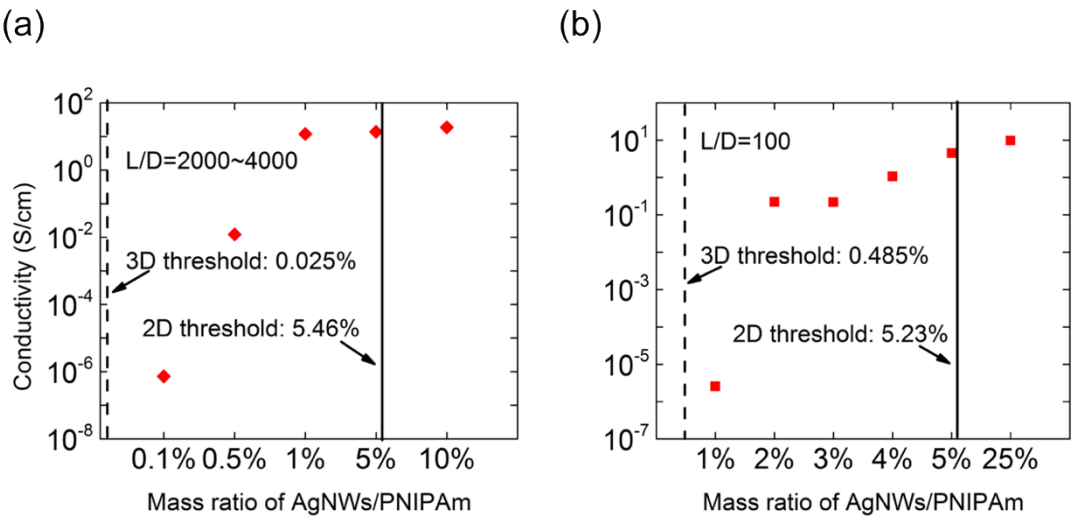

Figure S5. Conductivity of varying mass ratio AgNWs/PNIPAm with AgNW aspect ratio L/D 2000~4000 (a) and 100 (b). Dotted line represents the 3D theoretical electrical percolation threshold for isotropically oriented cylinders with identical aspect ratios. Solid line represents the 2D theoretical electrical percolation threshold for isotropically oriented rectangles.

Figure S6. Optical image of powered SMD LED connected to 1mm linewidth AgNW/MC traces.

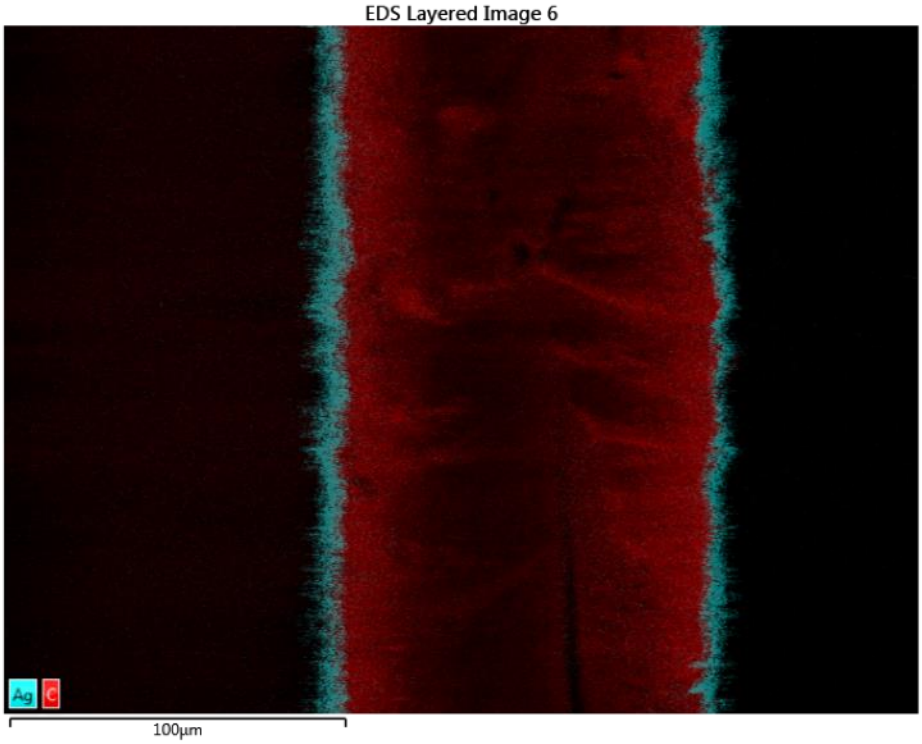

Figure S7. Energy dispersive spectroscopy (EDS) (Zeiss Merlin with Oxford X-Max50 Silicon Drift Detector) image of parallel plate capacitor built by attaching two slabs of AgNW/MC film together. Blue indicates Ag and red indicates C.

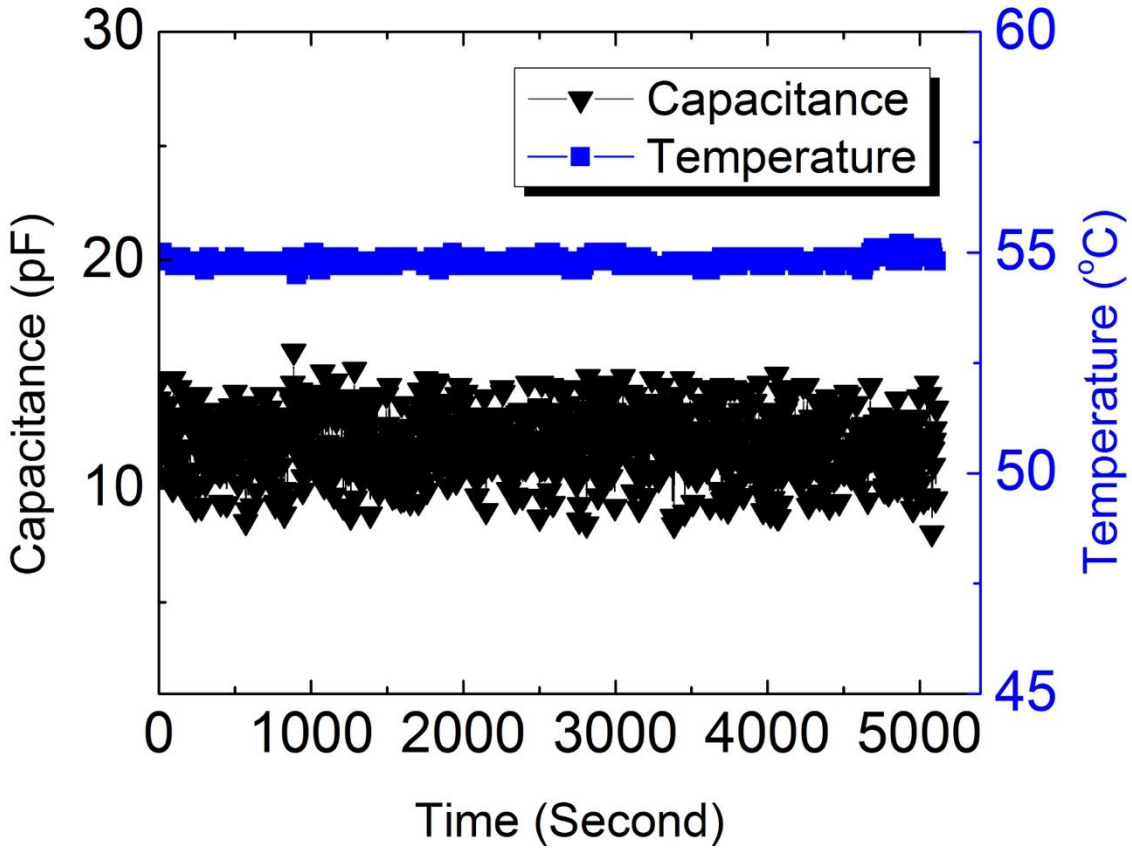

Figure S8. Capacitance change over time when the dry capacitor was placed on a hot plate.

(a) (b)

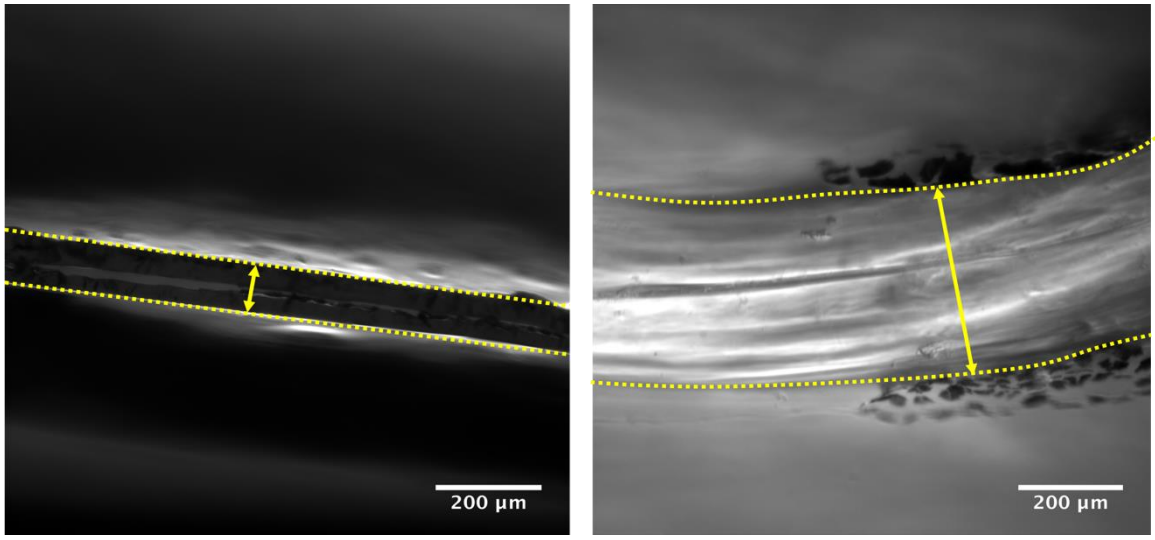

Figure S9. Optical images of capacitor cross-section in dry state (a) and hydrated state (b) with thickness of 100 µm and 375 µm, respectively. The yellow arrow indicates where the MC film thickness was measured, and the yellow dashed lines indicates the outer edges of the film.