

Supplementary information

Infrared actuation-induced simultaneous reconfiguration of surface color and morphology for soft robotics

Seyedali Banisadr & Jian Chen*

Department of Chemistry and Biochemistry, University of Wisconsin-Milwaukee, Milwaukee,
3210 North Cramer Street, Milwaukee, WI 53211, United States

Correspondence and requests for materials should be addressed to J.C. (email:
jianchen@uwm.edu)

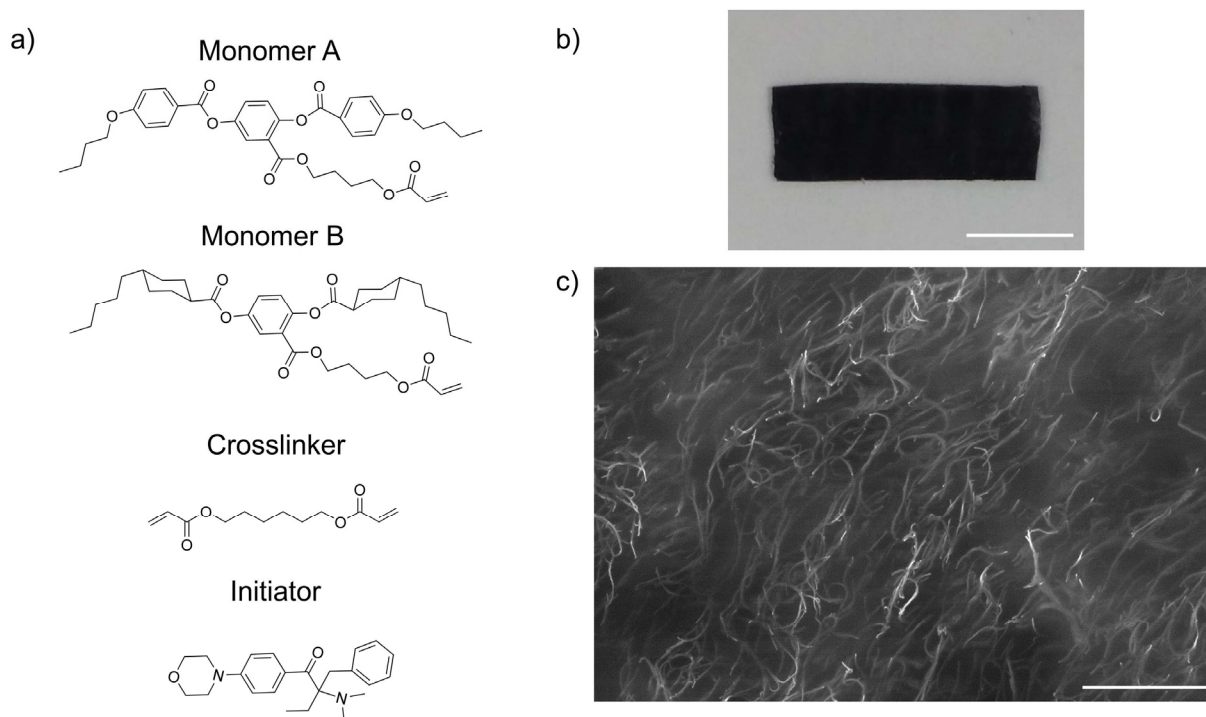


Figure S1. (a) Chemical structures of monomers, crosslinker, and initiator used in the preparation of LCE composites. (b) Photograph of the 0.1 wt% SWNT-LCE film. Scale bar: 5 mm. (c) SEM image of SWNTs in the 0.1 wt% SWNT-LCE film. The hot-drawing direction is roughly 50° relative to the scale bar. Scale bar: 5 μm .

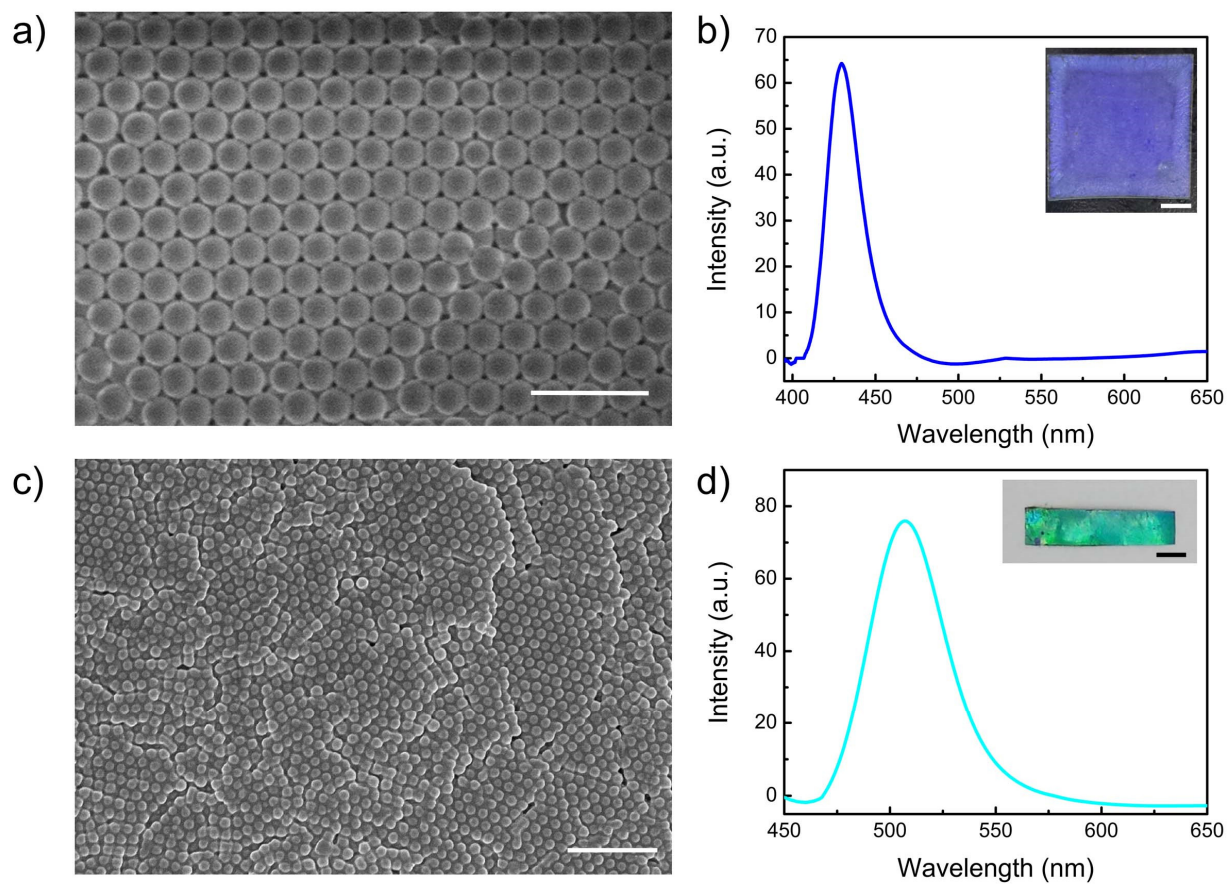


Figure S2. (a) SEM image of crosslinked PS nanospheres with diameter ~ 180 nm. Scale bar: 500 nm. (b) Reflection spectrum ($\vartheta = 90^\circ$) and photograph (inset) of the self-assembled photonic crystal film. Scale bar: 1 cm. (c) SEM image of crosslinked PS nanospheres embedded in PDMS matrix. Scale bar: 2 μm . (d) Reflection spectrum ($\vartheta = 90^\circ$) and photograph (inset) of the elastomeric photonic crystal film. Scale bar: 5 mm.

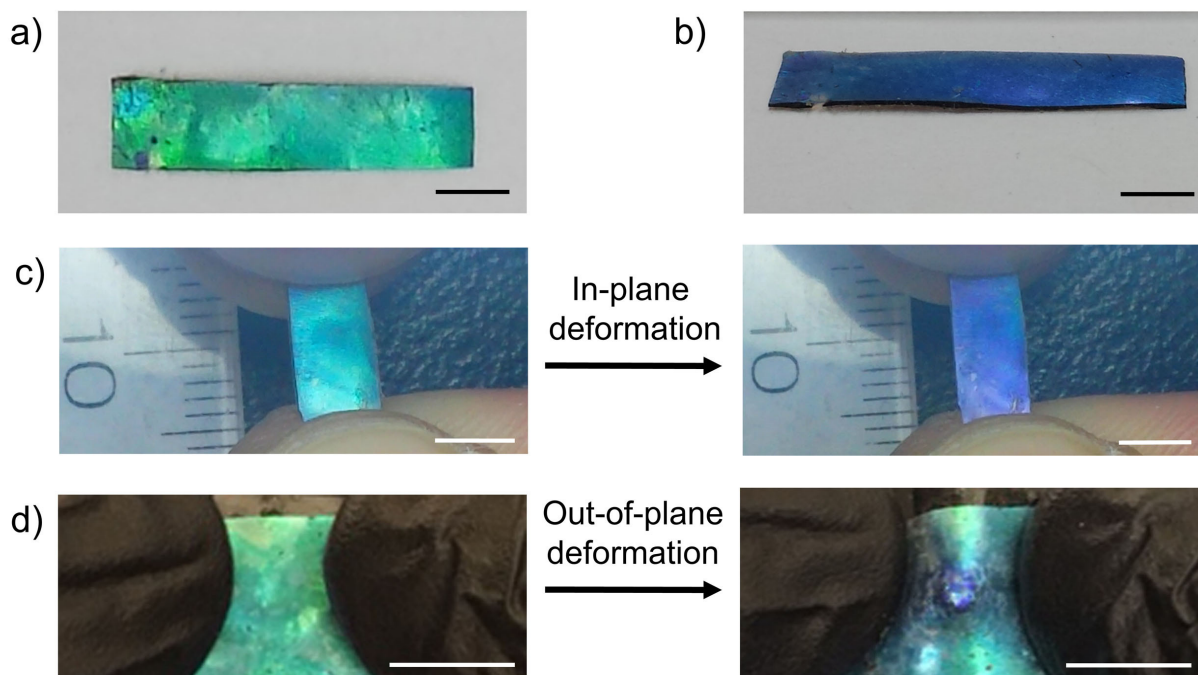


Figure S3. Photographs of (a) top view and (b) side view of the elastomeric photonic crystal film. (c) Photographs of the elastomeric photonic crystal film before and after being stretched. Scale bar: 5 mm. (d) Photographs of the elastomeric photonic crystal film before and after being deformed with a wooden stick. Scale bar: 1 cm.



Figure S4. Photographs (top view) of reversible twisting and untwisting of the laminated film in response to global IR irradiation. The top-view photographs are taken at the fixed angle that is perpendicular to the substrate. Scale bar: 5 mm.

Table S1. Mechanical properties of the 0.1 wt% SWNT-LCE and laminated films at room temperature.

Materials	Tensile modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
0.1 wt% SWNT-LCE film	0.68 ± 0.04	5.5 ± 1.0	41.0 ± 4.9
Laminated film	0.70 ± 0.09	6.3 ± 1.3	57.3 ± 4.9

Supplementary Movie S1: Reversible bending actuation of the laminated film upon global IR irradiation.

Supplementary Movie S2: Inchworm-like walking of the laminated film on glass in response to on and off cycles of global IR irradiation.