Supporting Information

Programmable 4D-Printed Soft Actuators: Harnessing Bending Strain Distribution for Embedded Topological Functionality

*Anas Saifi[a,c], Smruti Parimita[b], Amit Kumar[a], and Pijush Ghosh[a,c]**

[a]Department of Applied Mechanics and Biomedical Engineering, Indian Institute of Technology Madras, Chennai, 600036, India

[b]Manufacturing Engineering Section, Department of Mechanical Engineering, Indian Institute of Technology Madras, Chennai-600036, India

[c]Center for Soft and Biological Matter, Indian Institute of Technology Madras, Chennai 600036, India

*Corresponding author, Pijush Ghosh, E-mail: pijush@iitm.ac.in

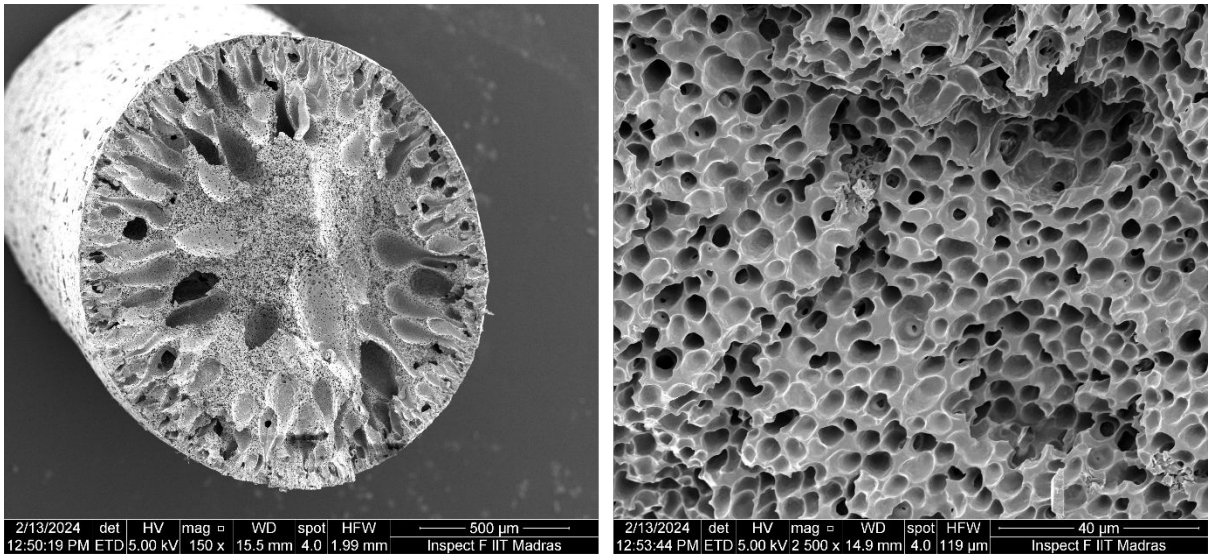

Figure S1. Cross-sectional SEM images of porous TPU-BIFA.

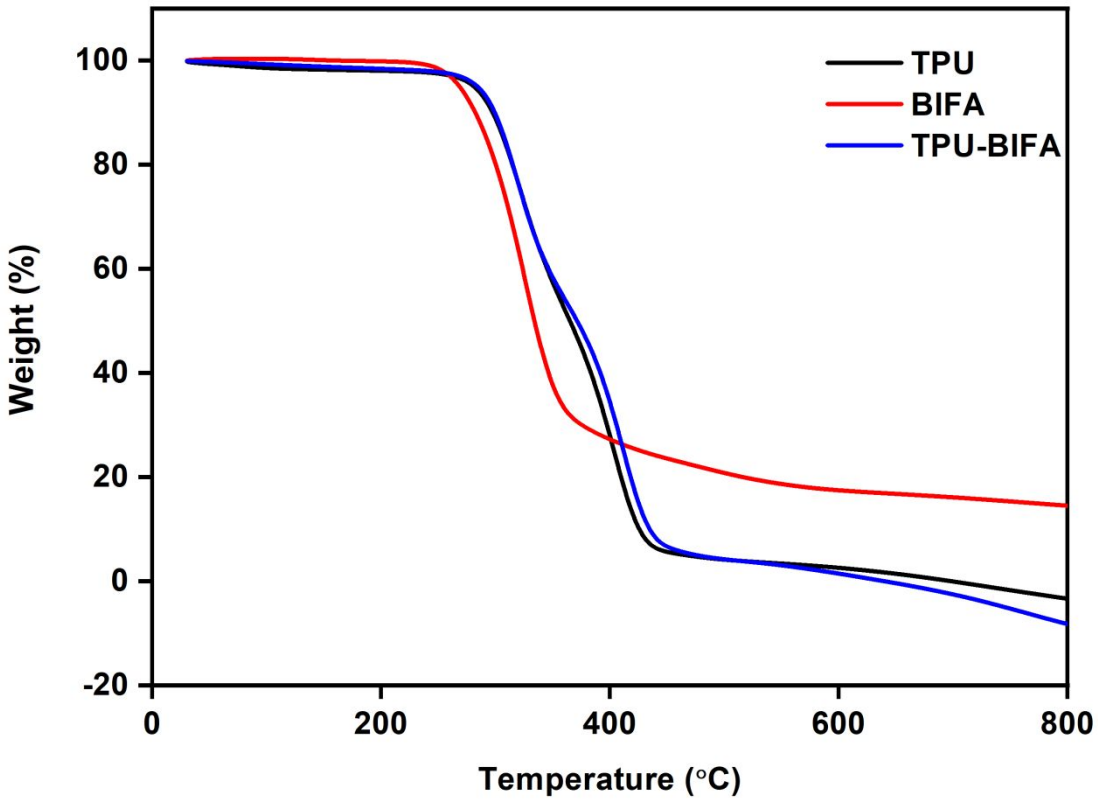

Figure S2. TGA curves of TPU, BIFA and its composite.

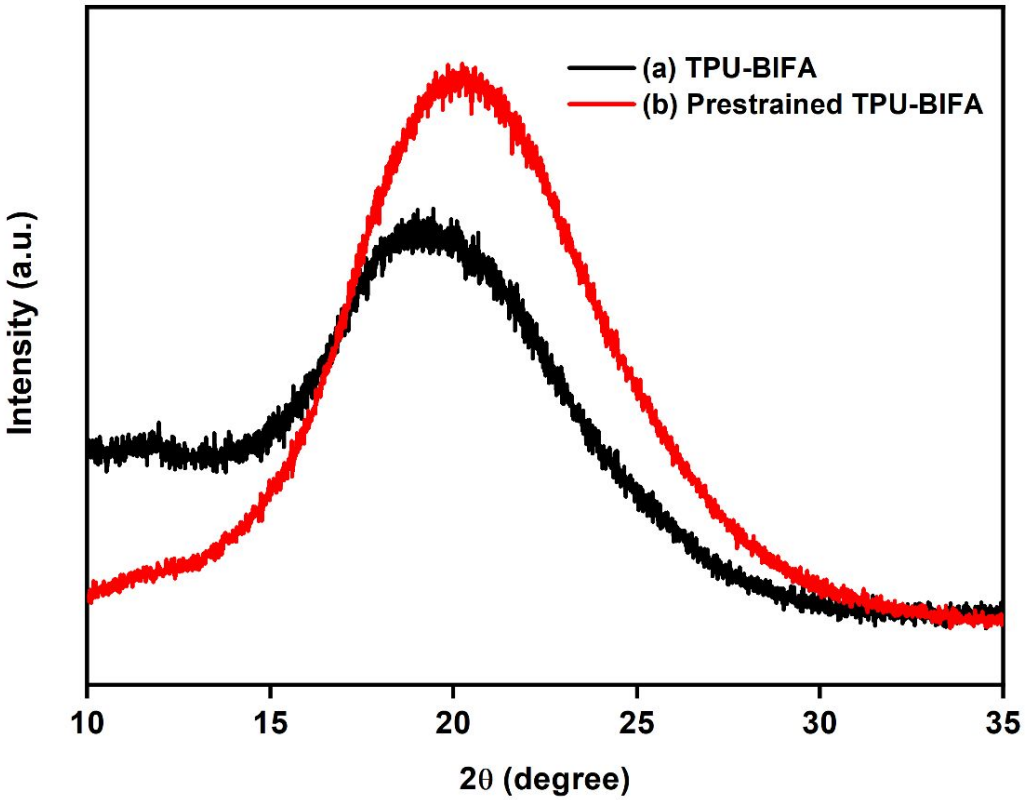

Figure S3. XRD of the TPU-BIFA before and after bending strain.

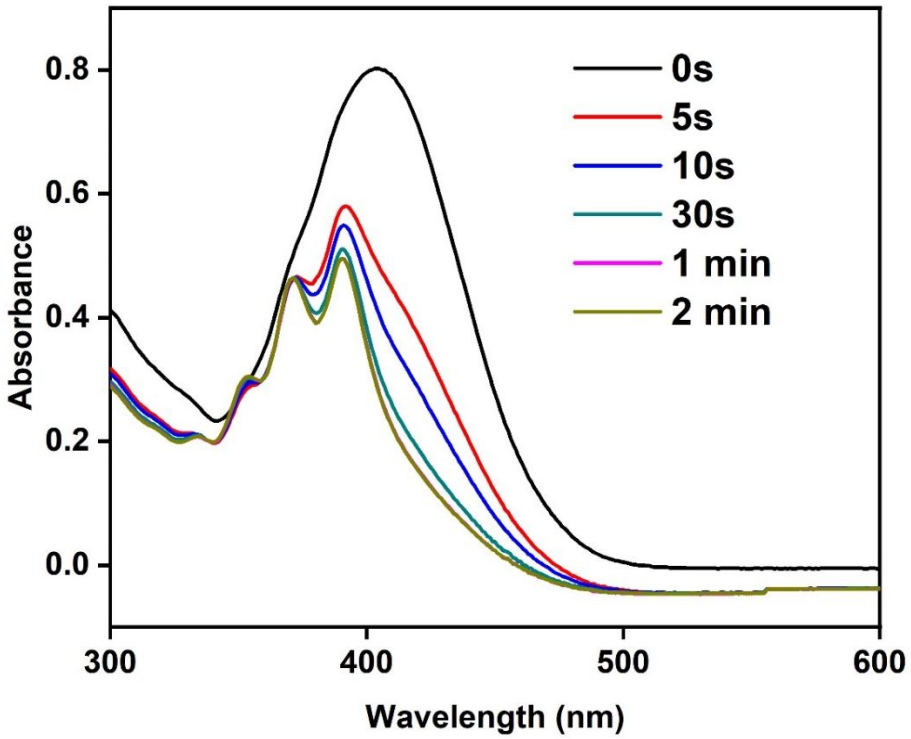

Figure S4. UV-vis spectra of BIFA dye solution in DMF irradiated with blue LED light (455 nm) for different period of time.

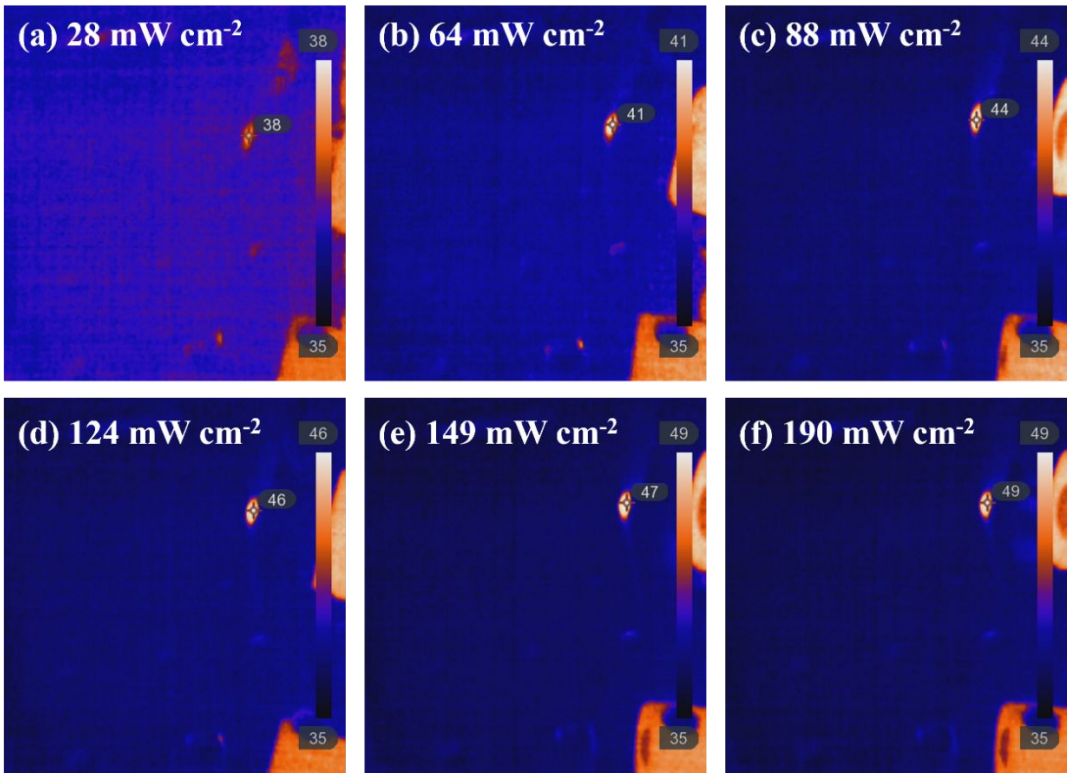

Figure S5. IR thermal images of filament irradiated with a blue light (455 nm) at different light intensities (a) 28 $mWcm^{-2}$, (b) 64 $mWcm^{-2}$, (c) 88 $mWcm^{-2}$, (d) 124 $mWcm^{-2}$, (e) 149 $mWcm^{-2}$, (f) 190 $mWcm^{-2}$.

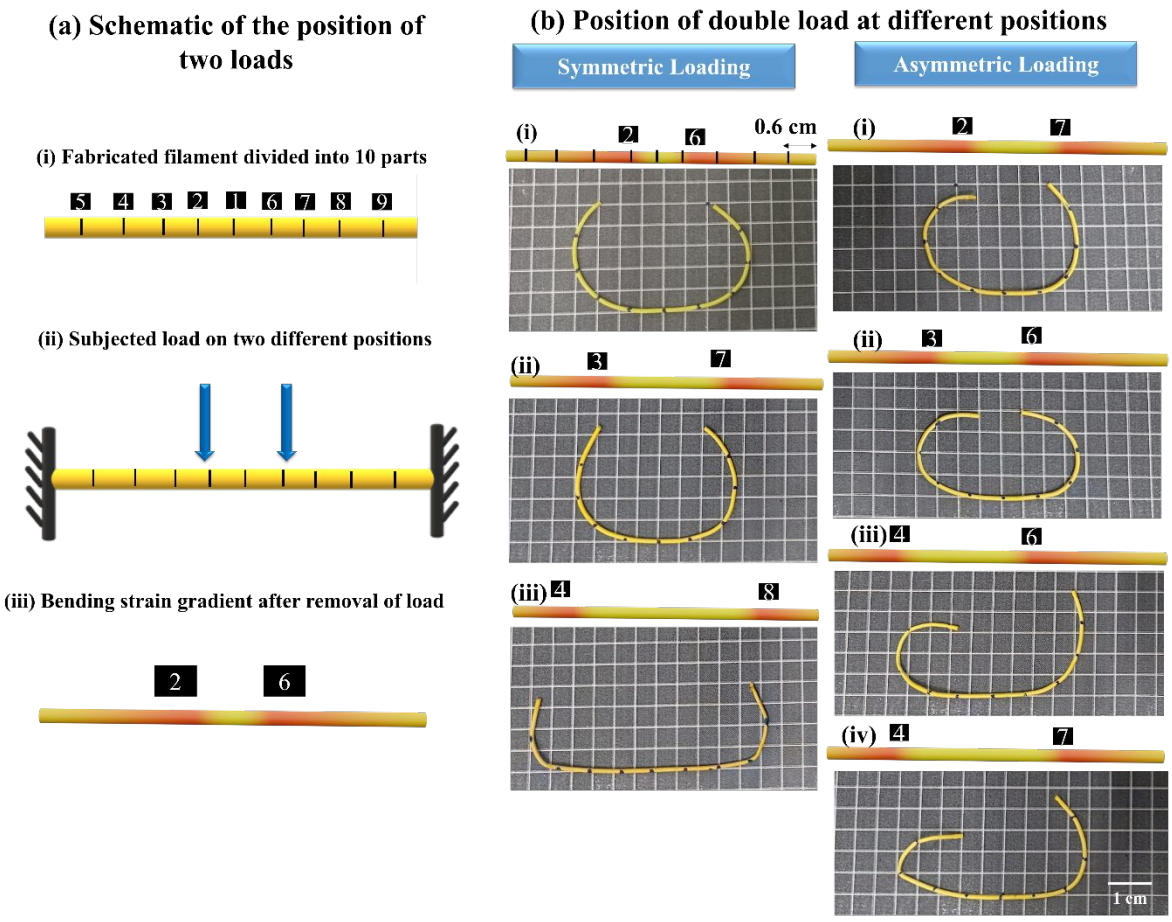

Figure S6. (a) Schematic representation of two loads subjected at different positions. (b) Comparison of light-induced curvature of the TPU-BIFA filaments when subjected to two-point loads, i.e., symmetric and asymmetric loads at different positions.

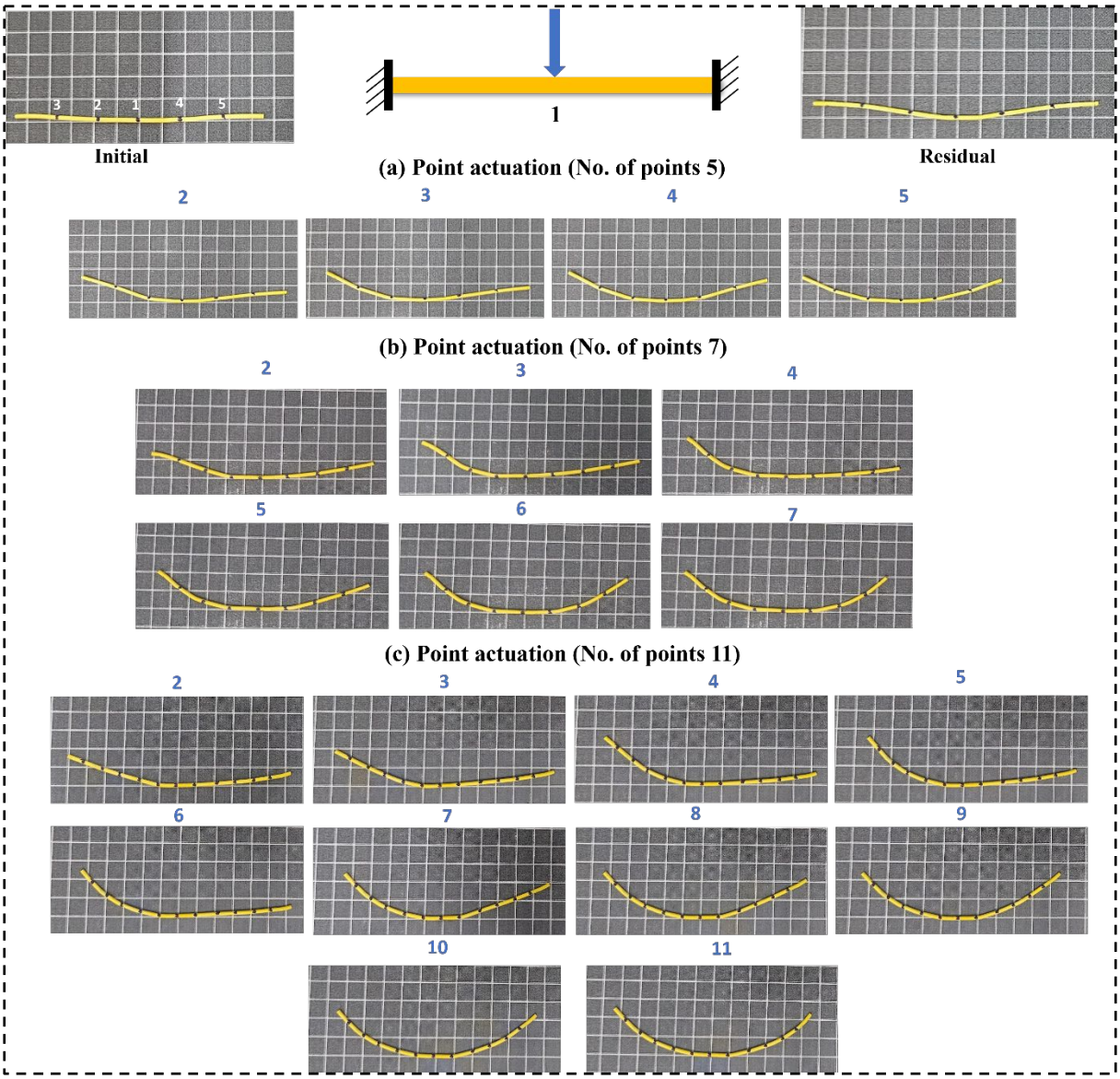

Figure S7. Digital images of the curvature change at each point by varying the number of light irradiation points (a) 5, (b) 7, and (c) 11.

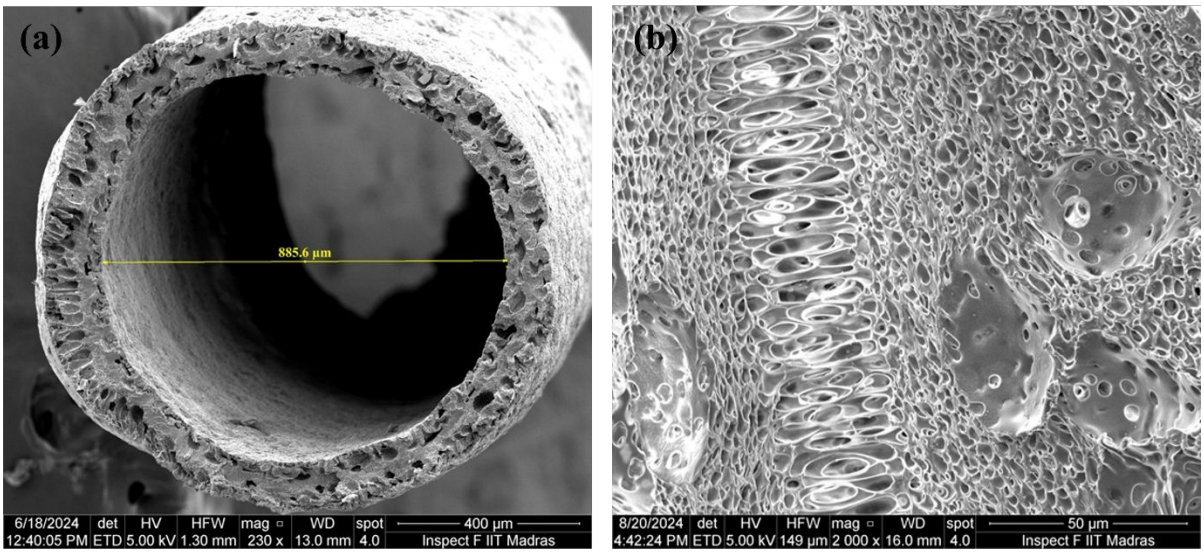

Figure S8. Cross-sectional SEM images of porous and hollow TPU (future work): (a) radial cross-sectioned view, (b) longitudinal cross-section view.