Electronic Supplementary Information

Effect of variations in manufacturing and material properties on the self-folding behaviors of hydrogel and elastomer bilayer structures

Jiayu Zhao¹, Hesaneh Kazemi², H. Alicia Kim²,⁴,⁵, Jinhye Bae¹, ³, ⁴, ⁵*

¹Department of NanoEngineering, University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA.

²Structural Engineering Department University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA.

³Chemical Engineering Program, University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA.

⁴Material Science and Engineering Program, University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA.

⁵Sustainable Power and Energy Center (SPEC), University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA.

*Corresponding author. Email: j3bae@ucsd.edu (Jinhye Bae)
Fig. S1. A cubic curve fitting over the length ratio $\frac{\Delta L}{L_0}$ of NC-PNIPAM as a function of temperature $T$. 

Cubic: $y = -5.402e-05 \cdot x^3 + 0.006673 \cdot x^2 - 0.2938 \cdot x + 4.625$

$R^2 = 0.9988$

Norm of residuals = 0.02325
Fig. S2. Stress-strain curves of the NC-PNIPAM at (A) swelled state and (B) de-swelled state, and (C) PDMS substrate.
Fig. S3. Photographs of (A) swelled and (B) de-swelled NC-PNIPAM (i) before and (ii) after stretching, in which \( w_0 \) and \( w_f \) refers to the initial and final width of the tested sample, respectively.
**Fig. S4.** Optical microscope photographs of the cross-sectional view of the hinge-based bilayer structure of NC-PNIPAM/PDMS printed with the target thickness ($h_1 = 0.6 \text{ mm}$, $h_2 = 0.4 \text{ mm}$). (A) Sample #4 with $h_1 = 0.586 \text{ mm}$, $h_2 = 0.369 \text{ mm}$; (B) sample #5 with $h_1 = 0.640 \text{ mm}$, $h_2 = 0.394 \text{ mm}$. 


Fig. S5. Optical microscope photographs of the hinge-based bilayer structure of NC-PNIPAM/PDMS sample #1 - #5 de-swelled at 45 °C and swelled at 22 °C (A)-(E), respectively.