

## Supporting Information

### Dual-Stimulus Bilayer Hydrogel Actuators with Rapid, Reversible, Bidirectional Bending Behaviors

Xiaomin He<sup>†</sup>, Yan Sun<sup>†</sup>, Jiahui Wu<sup>†</sup>, Yang Wang<sup>†</sup>, Feng Chen<sup>†</sup>, Ping Fan<sup>†</sup>, Mingqiang Zhong<sup>†</sup>,  
Shengwei Xiao<sup>‡</sup>, Dong Zhang<sup>¶</sup>, Jintao Yang<sup>\*†</sup>, and Jie Zheng<sup>\*¶</sup>

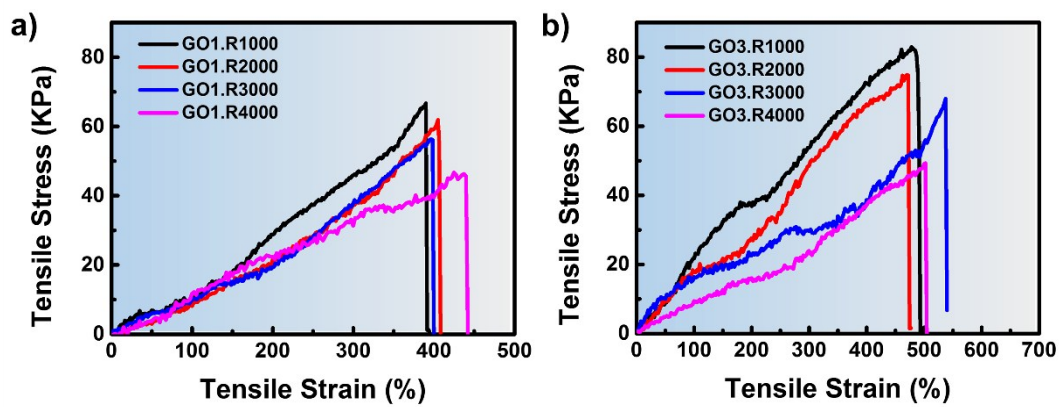
<sup>†</sup> College of Materials Science & Engineering  
Zhejiang University of Technology, Hangzhou 310014, China

<sup>‡</sup> School of Pharmaceutical and Chemical Engineering  
Taizhou University, Jiaojiang 318000, China

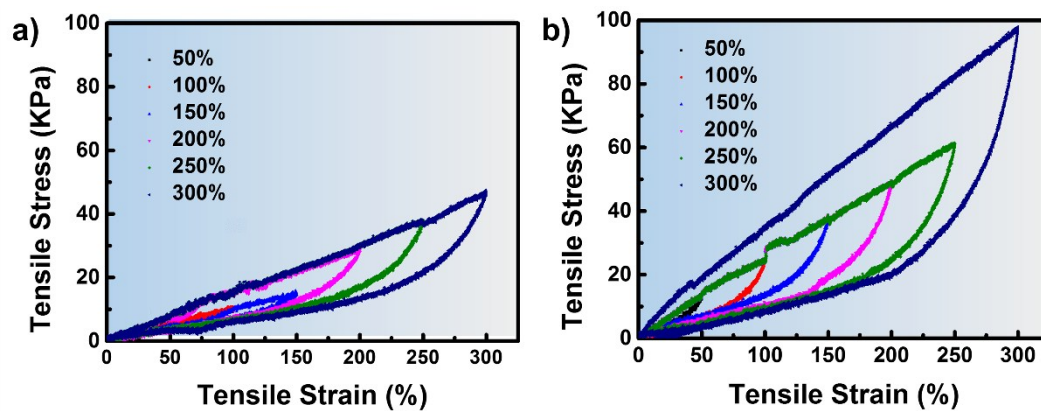
<sup>¶</sup> Department of Chemical and Biomolecular Engineering  
The University of Akron, Akron, Ohio 44325, USA

**\*Corresponding Author:** (J.Y.) [yangjt@zjut.edu.cn](mailto:yangjt@zjut.edu.cn); (J.Z.) [zhengj@uakron.edu](mailto:zhengj@uakron.edu)

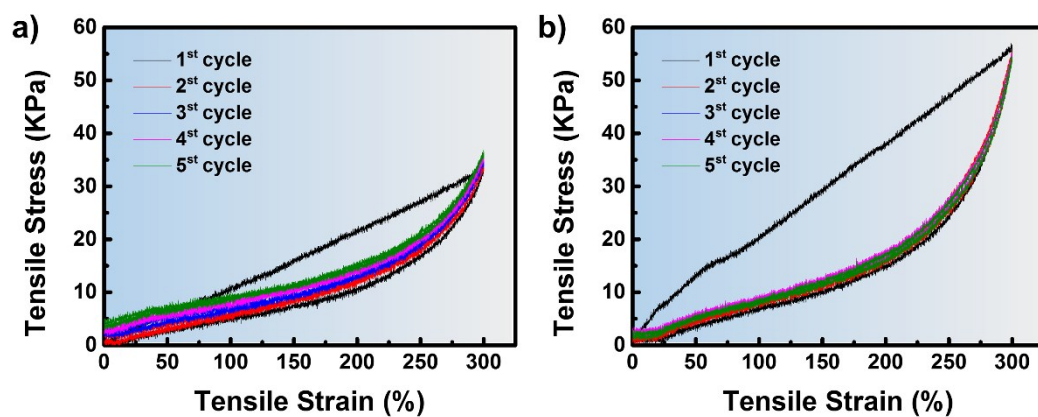
**Keywords:** PolyNIPAM, GO, Hydrogel, Bilayer structure, Actuation



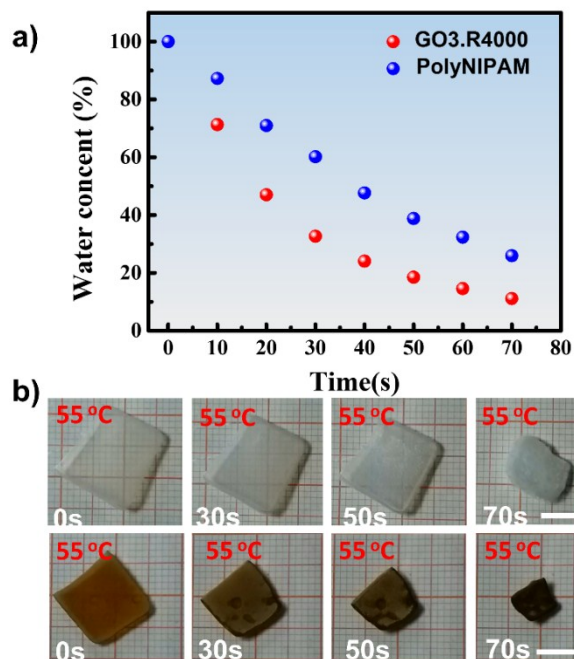
**Figure S1.** Tensile stress-strain curves of polyNIPAM/GO bilayer hydrogels prepared at a constant GO concentration of (a) 1.0 mg/mL and (b) 3.0 mg/mL with different centrifugation speeds of 1000, 2000, 3000, and 4000 rpm.



**Figure S2.** Cyclic loading–unloading curves of (a) GO1.R1000 and (b) GO3.R3000 hydrogels at different tensile strains.



**Figure S3.** Cyclic loading–unloading curves of (a) GO1.R1000 and (b) GO3.R3000 hydrogels at the same strain of 300 %.



**Figure S4.** (a) Deswelling kinetics and (b) volume change of pristine polyNIPAM hydrogel and polyNIPAM/GO hydrogel after immersing into 55 °C water. Scale bar=1 cm.