

## Support Information

### **Multifunctional Stimuli-Responsive Hydrogels with Self-Healing, High Conductivity and Rapid Recovery through Host-Guest Interactions**

Zexing Deng <sup>a</sup>, Yi Guo <sup>a</sup>, Xin Zhao <sup>a</sup>, Peter X. Ma <sup>b,c,d,e</sup>, Baolin Guo <sup>a,\*</sup>

<sup>a</sup> *Frontier Institute of Science and Technology, and State Key Laboratory for Mechanical Behavior of Materials, Xi'an Jiaotong University, Xi'an, 710049, China*

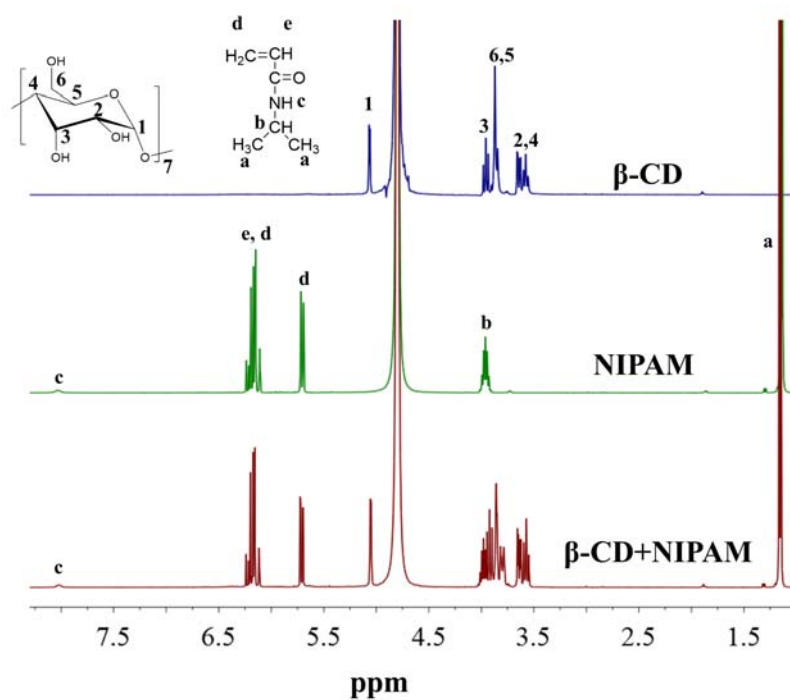
<sup>b</sup> *Department of Biomedical Engineering, University of Michigan, Ann Arbor, MI 48109, USA*

<sup>c</sup> *Department of Biologic and Materials Sciences, University of Michigan, Ann Arbor, MI 48109, USA*

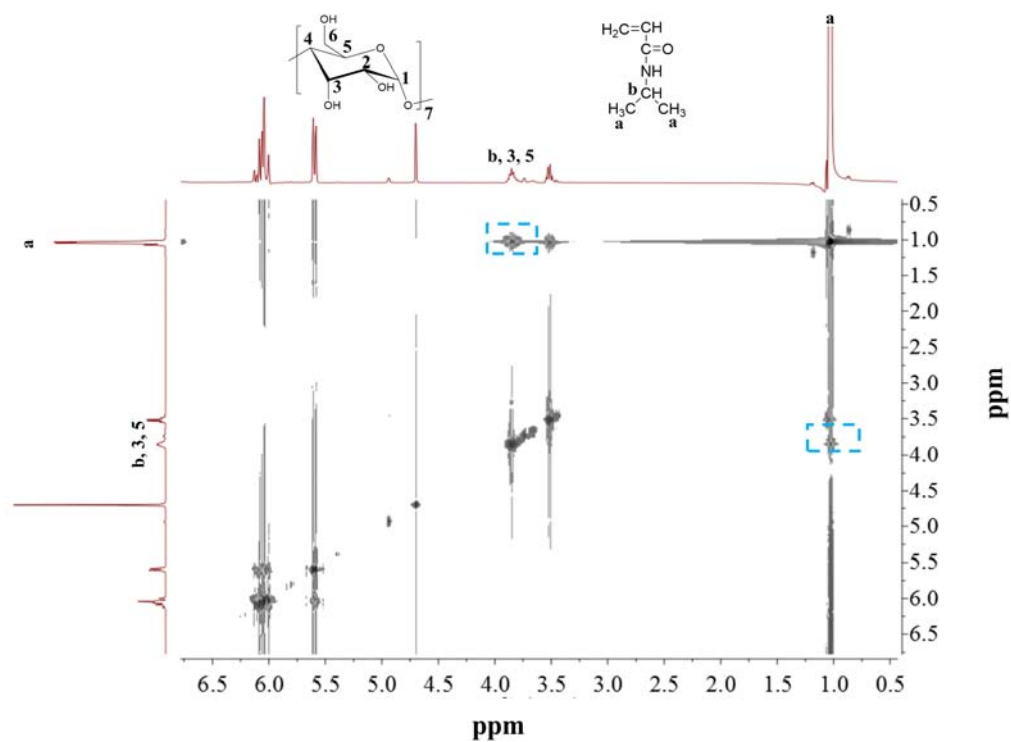
<sup>d</sup> *Macromolecular Science and Engineering Center, University of Michigan, Ann Arbor, MI 48109, USA*

<sup>e</sup> *Department of Materials Science and Engineering, University of Michigan, Ann Arbor, MI 48109, USA*

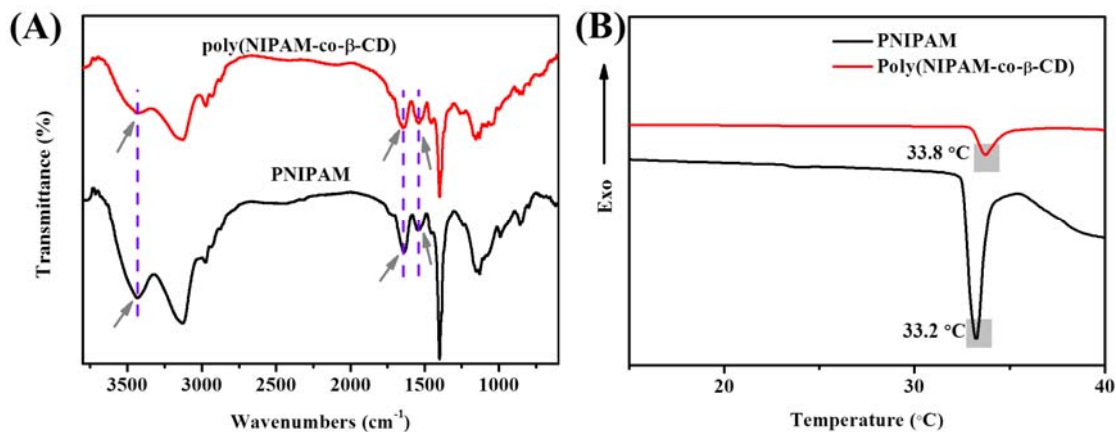
\* To whom correspondence should be addressed. Tel.: +86-29-83395363. Fax: +86-29-83395131. E-mail: baoling@mail.xjtu.edu.cn



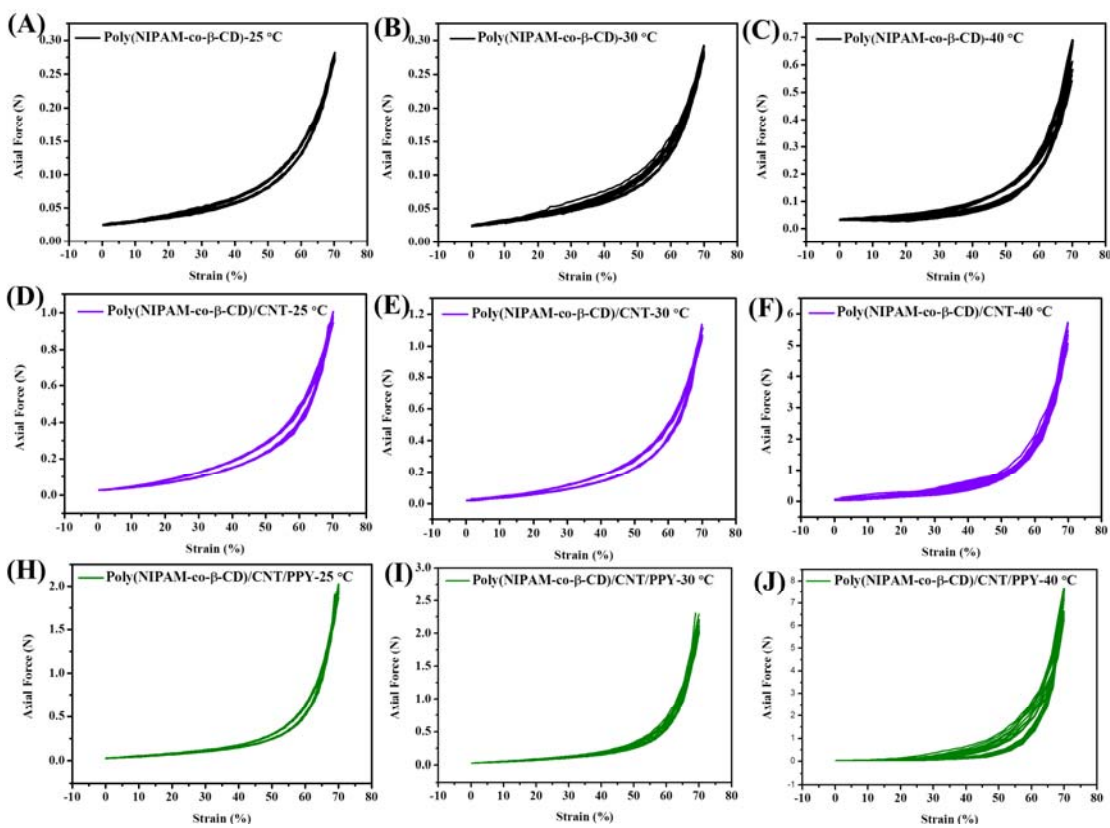
**Figure S1.**  $^1\text{H}$  NMR spectra of  $\beta$ -CD, NIPAM and  $\beta$ -CD/NIPAM.



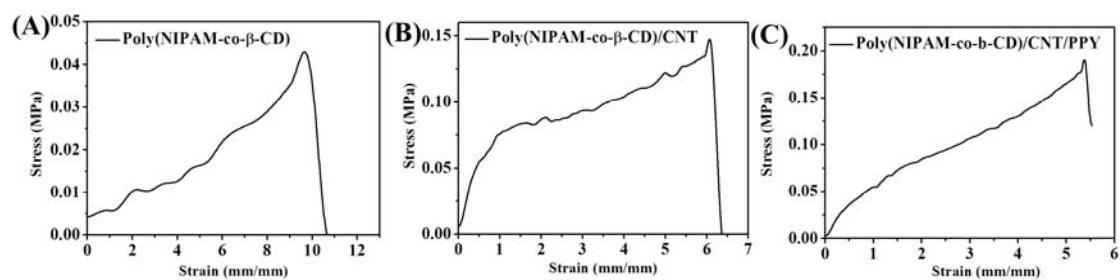
**Figure S2.** 2D NOESY NMR of  $\beta$ -CD/NIPAM.



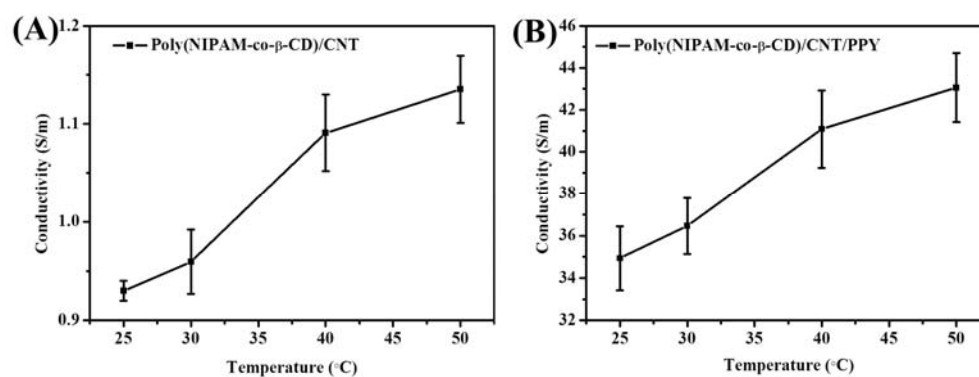
**Figure S3.** FT-IR results of PNIPAM and poly(NIPAM-co- $\beta$ -CD) (A), DSC curves of PNIPAM and poly(NIPAM-co- $\beta$ -CD) (B).



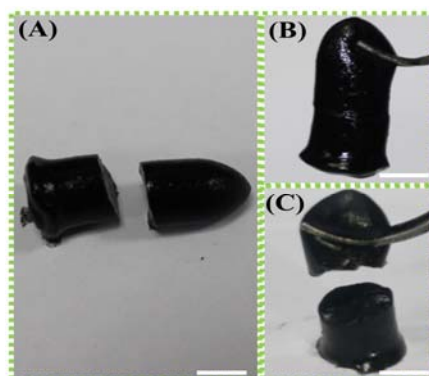
**Figure S4.** Compression and tension curves of 10 cycles of hydrogels at 70% strain at 25  $^{\circ}\text{C}$ , 30  $^{\circ}\text{C}$  and 40  $^{\circ}\text{C}$ , respectively.



**Figure S5.** Representative tensile stress-strain curves of poly(NIPAM-co- $\beta$ -CD) hydrogel (A), poly(NIPAM-co- $\beta$ -CD)/CNT hydrogel (B) and poly(NIPAM-co- $\beta$ -CD)/CNT/PPY hydrogel (C).



**Figure S6.** Temperature dependent conductivity of poly(NIPAM-co- $\beta$ -CD)/CNT hydrogel (A) and poly(NIPAM-co- $\beta$ -CD)/CNT/PPY hydrogel (B).



**Figure S7.** Self-healing behavior of hydrogel with or without competitive agent. The original hydrogels (A), self-healing behavior of poly(NIPAM-co- $\beta$ -CD)/CNT/PPY hydrogel without competitive agent adamantanamine (B) or with adamantanamine (C), scale bar: 5 mm.

## **Movies**

Movie S1. Photothermal behavior of the conductive hydrogel.

Movie S2. Conductive hydrogel was used to sensing finger motion.

Movie S3. Conductive hydrogel was used to sensing bicipital muscle of arm motion.

Movie S4. Self-healing behavior of conductive hydrogel with and without competitive agent adamantanamine.

Movie S5. Injectable behavior of non-conductive hydrogel and conductive hydrogel.