Electronic Supplementary Material (ESI) for Soft Matter.

Supporting Information

A strong and tough gelatin/polyvinyl alcohol double network hydrogel actuator with superior actuation strength and fast actuation speed

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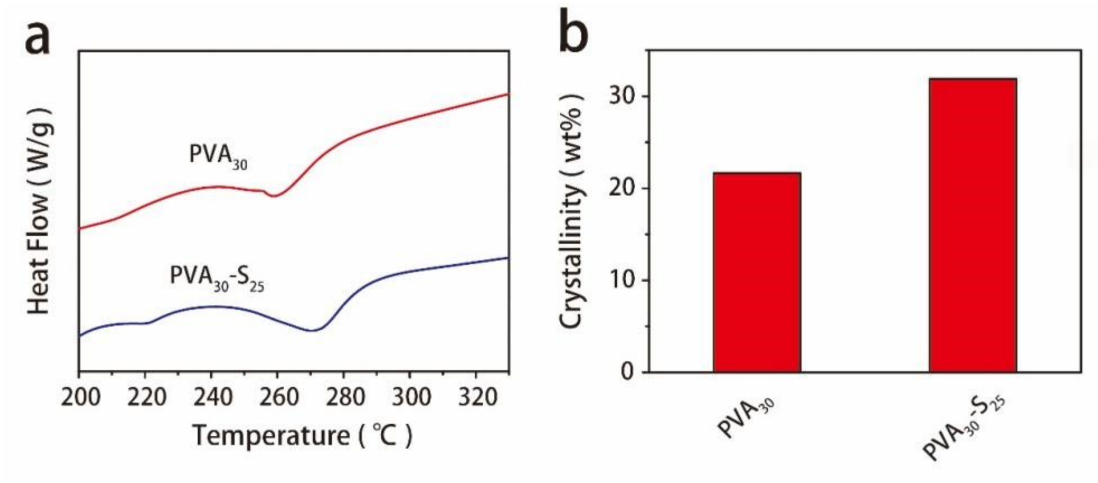

Fig.S1. (a) DSC curves of the PVA_{30} gel and the PVA_{30}-S_{25} gel. The PVA_{30} gel was fabricated with 30 wt% PVA powder through the heating-cooling and freezing-thawing treatment. (b) The crystallinity of the PVA_{30} gel and the PVA_{30}-S_{25} gel.

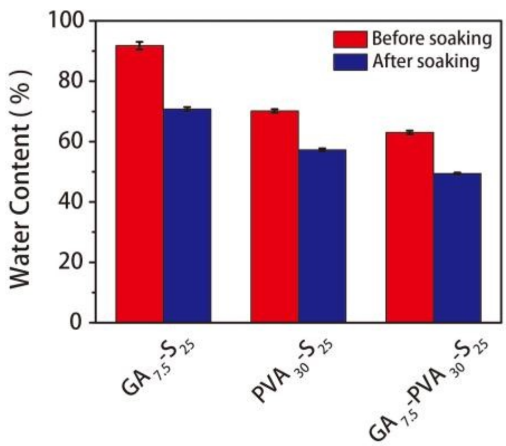

Fig.S2. Water content of the $GA_{7.5}$-S_{25} gel, the PVA_{30}-S_{25} gel, and the $GA_{7.5}$-PVA_{30}-S_{25} gel before immersing in the $(NH_4)_2SO_4$ solution and after immersing in the $(NH_4)_2SO_4$ solution.

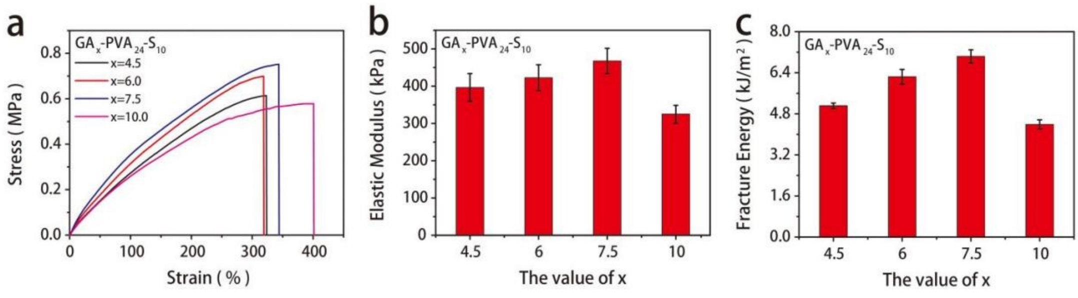

Fig.S3. (a) Tensile stress-strain curves of the GA_x-PVA_{24}-S_{10} gel with various weight

percentages of gelatin. (b) Elastic modulus of the GA_x-PVA_{24}-S_{10} gel. (c) Fracture energy of the GA_x-PVA_{24}-S_{10} gel.

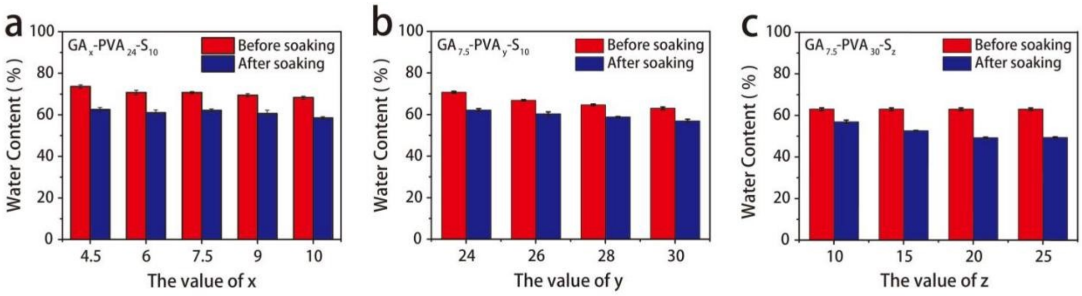

Fig.S4. (a) Water content of the GA_x-PVA_{24}-S_{10} gel before immersing in the $(NH_4)_2SO_4$ solution and after immersing in the $(NH_4)_2SO_4$ solution. (b) Water content of the $GA_{7.5}$-PVA_y-S_{10} gel. (c) Water content of the $GA_{7.5}$-PVA_{30}-S_z gel.

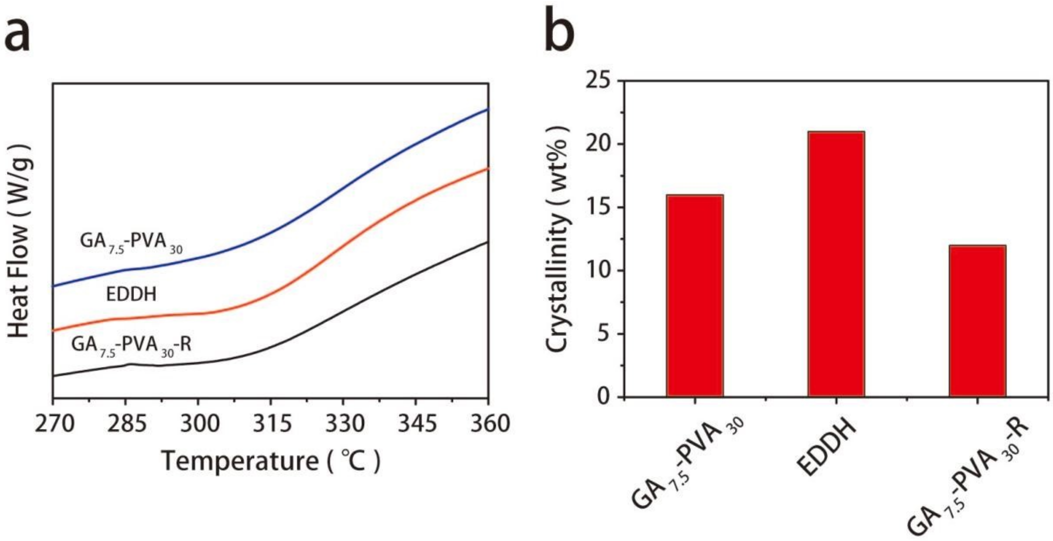

Fig.S5. (a) DSC curves of the $GA_{7.5}$-PVA_{30} gel, the EDDH and the $GA_{7.5}$-PVA_{30}-R gel. (b) The crystallinity of the $GA_{7.5}$-PVA_{30} gel, the EDDH and the $GA_{7.5}$-PVA_{30}-R gel.

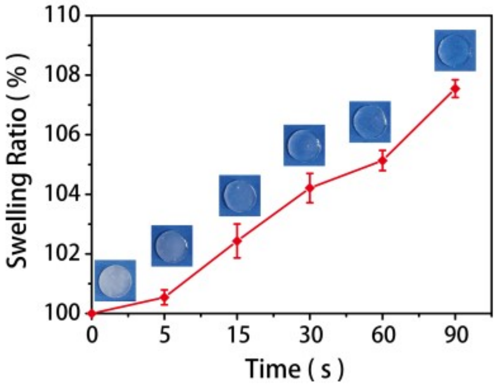

Fig.S6. Swelling ratio of $GA_{7.5}$-PVA_{30}-S_{25} gel as a function of time under the stimulation of hot water at 80 ℃.

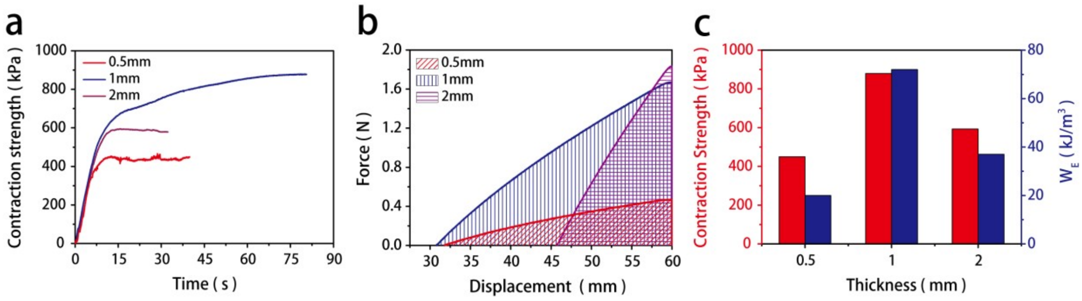

Fig.S7. (a) ~~Contractile~~Contraction strength of 300% EDDH ~~placed for different time~~with different thicknesses as a function of stimulation time. (b) Force-displacement curves of 300% EDDH ~~placed for different time~~with different thicknesses. (c) ~~Contractile~~Contraction strength and output working density W_E of 300% EDDH ~~placed for different time~~with different thicknesses.

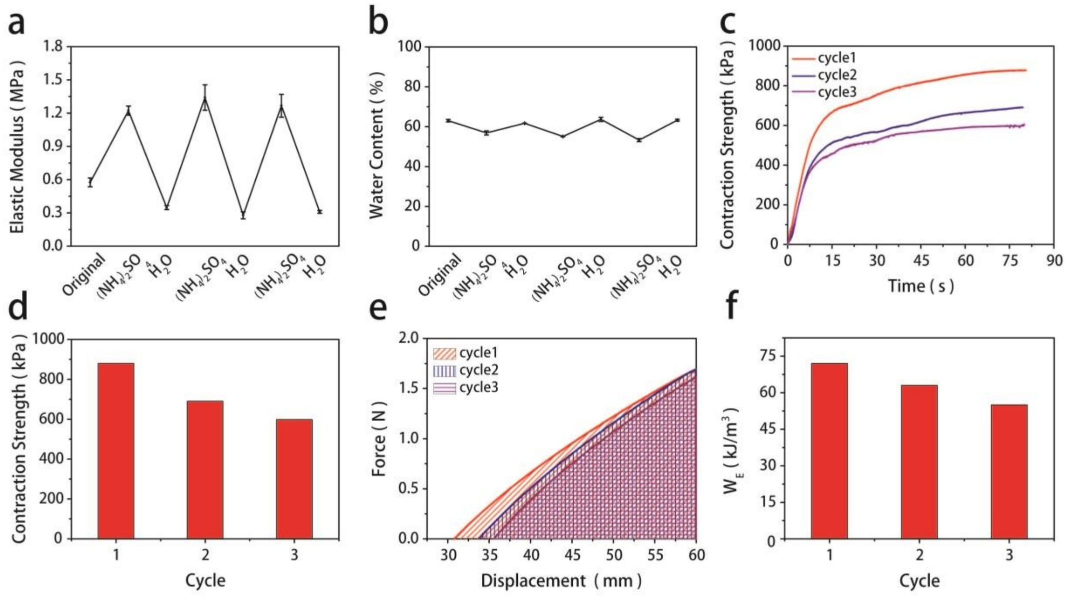

Fig.S8. (a) Elastic modulus of $GA_{7.5}$-PVA_{30}-S_{25} gel during three cycles. (b) Water content of $GA_{7.5}$-PVA_{30}-S_{25} gel during three cycles. (c) Contraction strength of 300% EDDH as a

function of stimulation time. (d) Contraction strength of 300% EDDH. (e) Force-displacement curves of 300% EDDH. (f) Output working density W_E of 300% EDDH.