Supporting Information

Bioinspired Smart Actuator Based on Graphene Oxide-Polymer Hybrid Hydrogels

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Preparation of Fe_3O_4 nanoparticles

A mixture of 1.0 g of $FeCl_3 \cdot 6H_2O$ and 0.37 g of $FeCl_2 \cdot 4H_2O$ dissolved in 10 mL of water was added to a 50 mL three-necked round bottom flask pre-immersed in an oil bath at 70 ^oC and the reaction was allowed to proceed for 2 h after quick droplet-addition of 4 mL of 16.5% $NH_3 \cdot H_2O$ under vigorous stirring. The resulting black precipitate was washed with anhydrous ethanol and centrifugalized several times, then re-dispersed in water under ultrasonic treatment. Finally, the aqueous Fe_3O_4 dispersion was obtained after another centrifugation at a speed of 10000 rpm for 5 min aiming to remove the undispersed Fe_3O_4 agglomeration. The average diameter of the Fe_3O_4 nanoparticles was about 10 nm (TEM result).

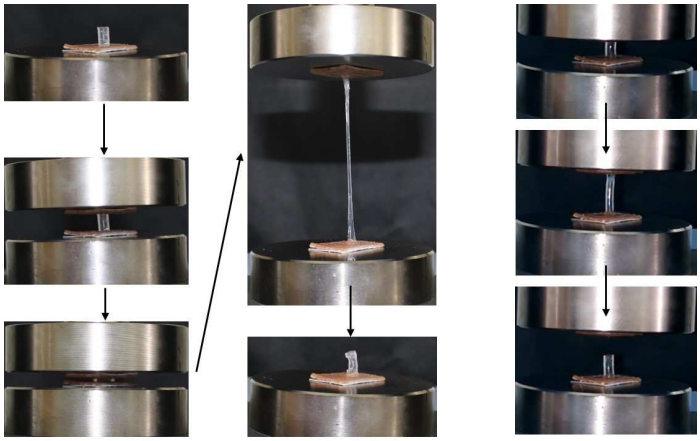

Figure S1. A: Adhesion strength test of the adhesive hydrogel D3G3CD8. B: Control test of the hydrogel D3G3. The hydrogel sample was placed on the fixed pig skin and pressed with another pig skin for 1 min to make the hydrogel tightly stuck on the pig skins. Then the hydrogel was stretched (crosshead speed: 100 mm/min) and the tensile stress-strain curve was recorded. The stress where the hydrogel was detached from the pig skin was considered as the adhesion strength. The adhesive strength of the D3G3CD8 hydrogel is 15 kPa, much higher than 5 kPa of the D3G3 hydrogel without α-CD. Thus, by introducing α-CD into the hydrogel, we have obtained a new kind of adhesive hydrogel with sufficient adhesive force in designing the hybrid hydrogel actuator.

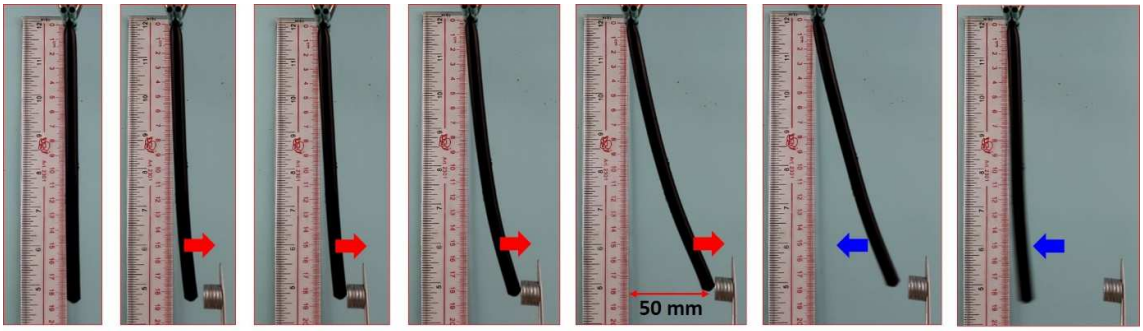

Figure S2. The magneticaly guiding actuation of the magnetic hydrogel D3G3Fe3. The magnetic hydrogel is attracted by a magnet and pulled away from the vertically hanged position.

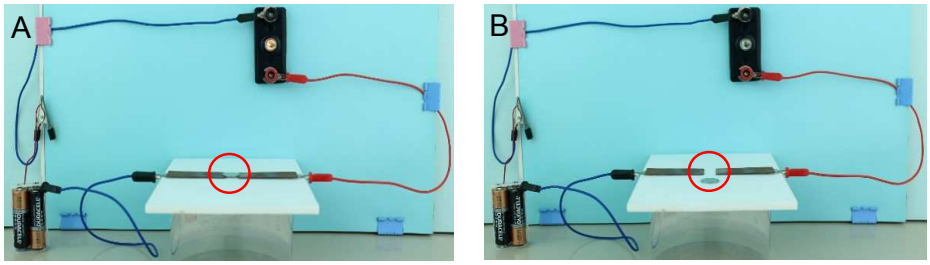

Figure S3. Photos of a complete electric circuit, A: switch on, B: switch off.

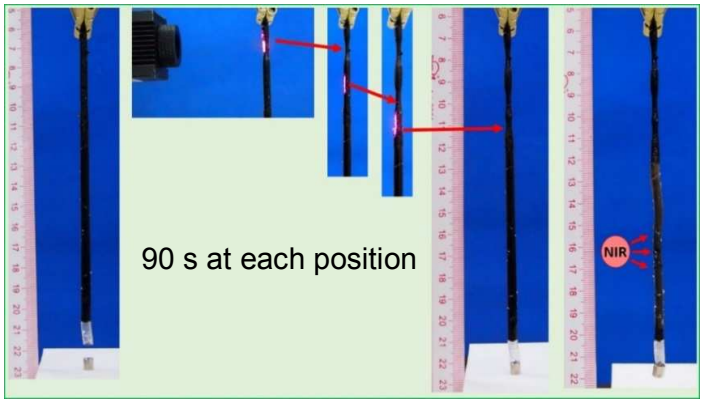

Figure S4. Actuation of the hybrid hydrogel actuator driven by NIR laser irradiation (808 nm, 1.6 W, exposing area of 5 mm × 5 mm). The contraction of the hydrogel actuator is still driven by NIR lamp irradiation.

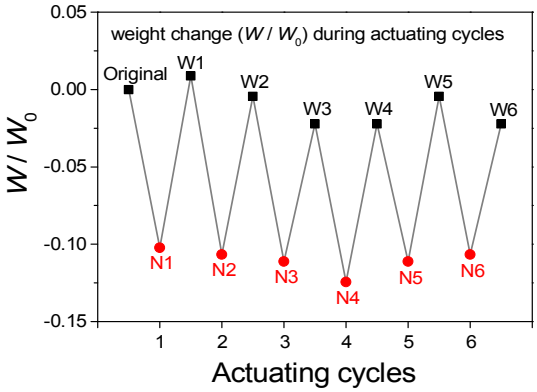

Figure S5. The relative weight of an actuating hydrogel after each actuation cycle (N*i*) and after immersed in deionized water for 15 min (W*i*) during repeat actuation, where *i* is the repeat time.