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Electronic Supplementary Information

A Multi-Stimuli Responsive Bidirectional Bending Actuator Based on Polypyrrole and Agar Nanocomposite

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Video S1. The PPy/AG actuator after being exposed to humidity.

Video S2. The PPy/AG actuator upon HCl gas exposure.

Video S3. The performance of pure agar film when exposed to HCl gas.

Video S4. The continuous shape changes of the PPy/AG actuator under the synergistic actuation of humidity and NIR light.

Video S5. The PPy/AG film undergoing reversible sheet to curled sheet transition under the stimulation of humidity and NIR light.

Video S6. A walking device based on PPy/AG actuator with cargo transportation and delivery capability. NIR light is utilized to lift and release the cargo, while humidity is used to make it walk on a grooved surface.

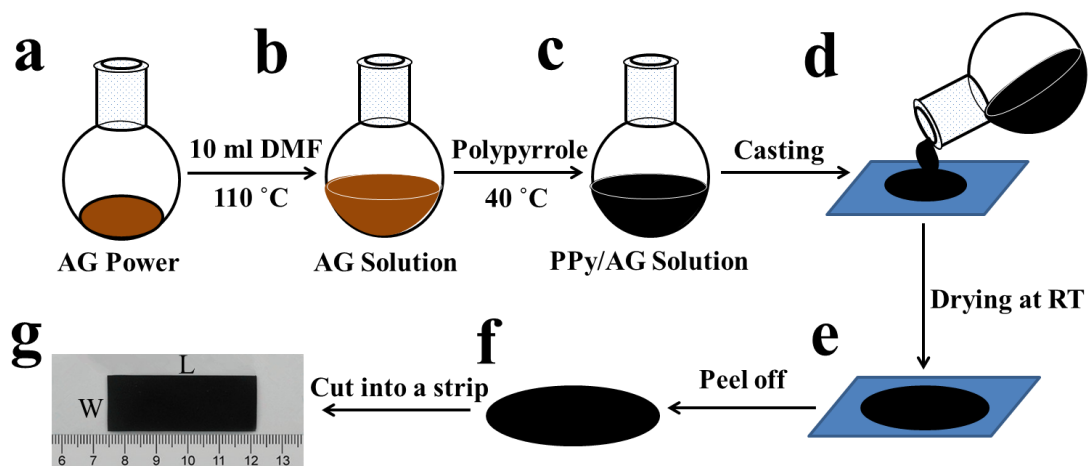


Fig. S1 Preparation process of the PPy/AG nanocomposite film.

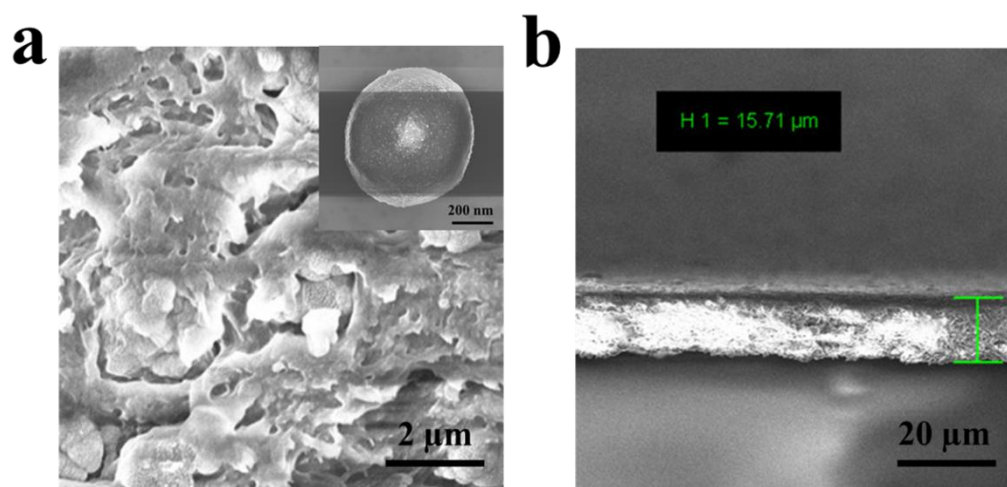


Fig. S2 a) Top view and b) side view SEM images showing AG blended with PPYNPs. Inset of a): Enlarged SEM image of one PPYNP.

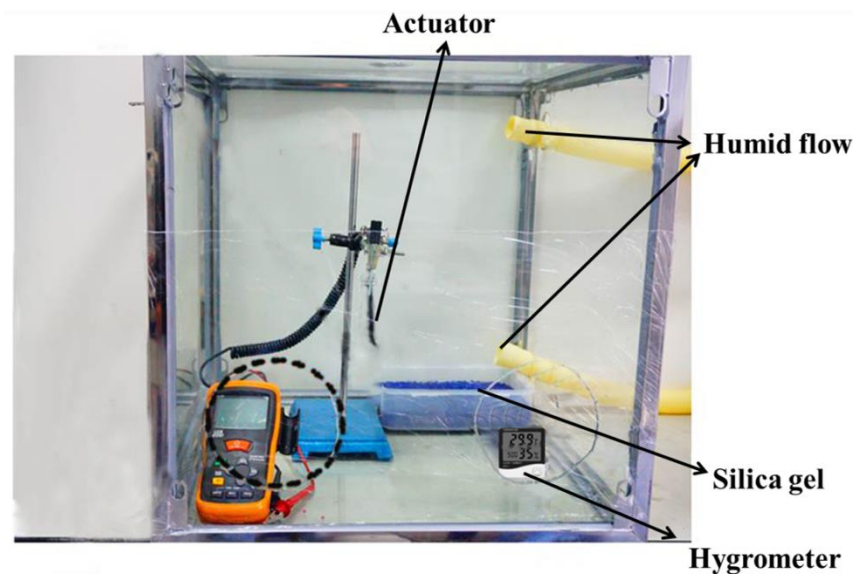


Fig. S3 CCD image of the home built humidity chamber for the humidity driven actuator study.

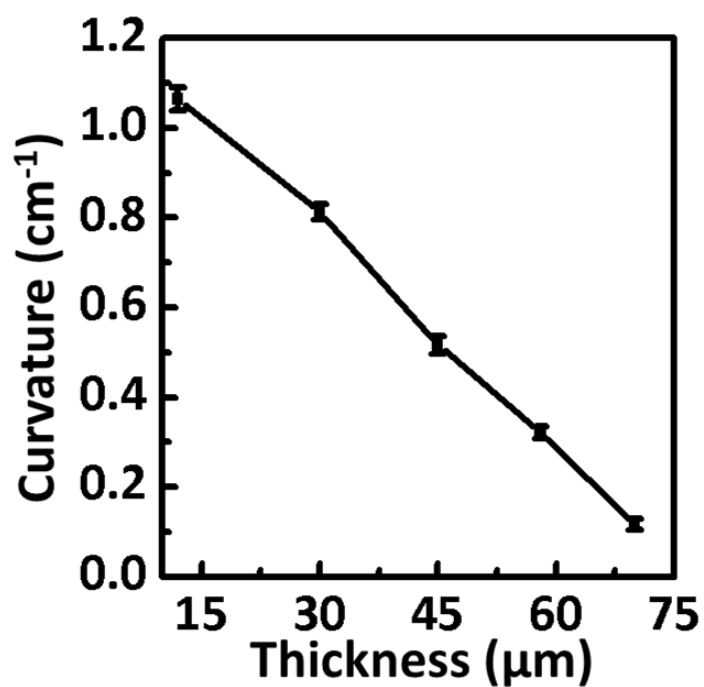


Fig. S4 The steady state curvature of the PPy/AG actuator decreases with the increasing film thickness at fixed humidity difference $\Delta\text{RH} = 50\%$.

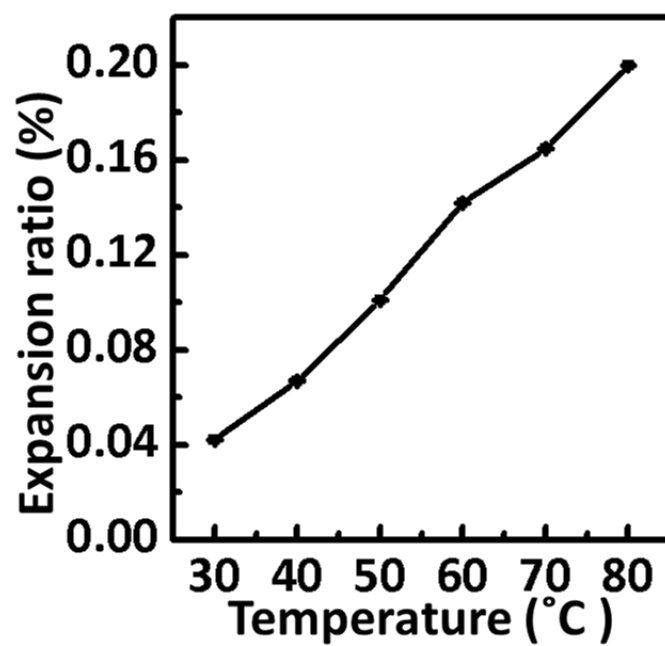


Fig. S5 The expansion ratio of the PPy/AG actuator increases with the increasing temperature.