Electronic Supplementary Material (ESI) for RSC Advances.

Preparation of conductive self-healing hydrogels via interpenetrating polymer network method

Huan-Jung Wang, Yi-Zuo Chu, Chen-Kang Chen, Yi-Shun Liao and Mei-Yu Yeh*

Department of Chemistry, Chung Yuan Christian University, Republic of China, Taiwan

Contents **Page Number**

Mechanical measurement

The stress-strain tests of hydrogels of **P6** and **P7** were carried out with the Discovery Hybrid Rheometer (DHR-2). In addition, the hydrogels were cut into halves, and the two separate parts were contacted with a drop of 0.1M NaOH. After 1 hr at room temperature, the stress-strain tests of **P6** and **P7** were repeated to evaluate the healing efficiency.

Resistance measurement

A two-probe method was used to evaluate the resistance of the hydrogels of **P6**-**P8**. The resistance of the original and self-healing sample was obtained by measuring the multimeter (Pro'sKit MT-2007N), employing the two-probe method.[S1]

Conductivity measurement

The conductivities of **P7** and **P8** were measured using a four-point probe technique and calculated using the equations derived by Van der Pauw.[S2] **P7** and **P8** hydrogels were prepared on the non-conductive side of ITO glass slides and small points of nickel print conductive bus material were applied to the corners of the hydrogels. A constant current was applied between two adjacent corners, and the voltage across the remaining two corners was measured. (Four-point probe system, LRS4-TK1).

LED emitting test

The **P7** hydrogel was used as a conductor in a circuit to light up a LED bulb with a constant voltage of 1.5 V. In addition, the **P7** hydrogel was cut into two pieces from middle and then the damaged hydrogel was contacted with a drop of 0.1M NaOH for 1 hr at room temperature to obtain the healed hydrogel. Finally, the conductive properties of the **P7** healed hydrogel was investigated using the above circuit.

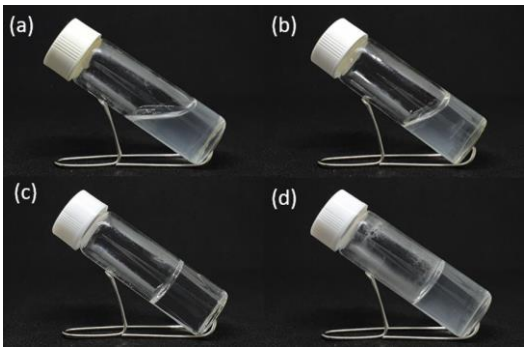

Fig. S1. Optical images of (a) 5, (b) 10, (c) 15 and (d) 20 % w/v of acrylamide.

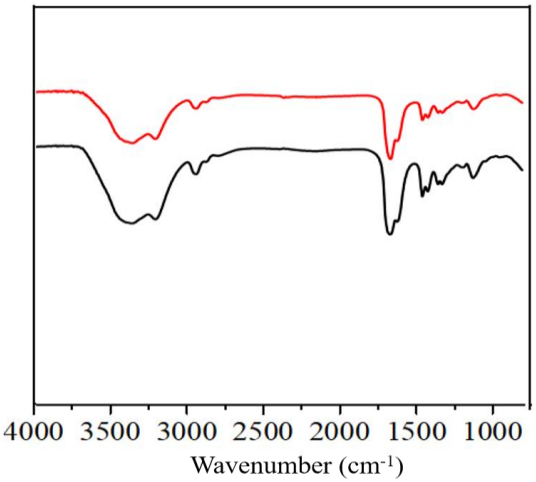

Fig. S2. FT-IR spectra of **P6** before (red) and after (black) heating.

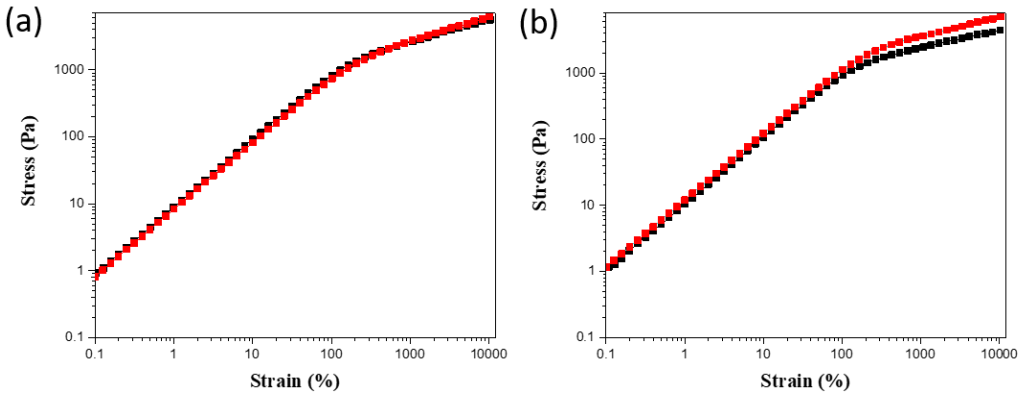

Fig. S3. The stress–strain curves of the original sample (black) and self-healing sample (red) of (a) **P6** and (b) **P7**.

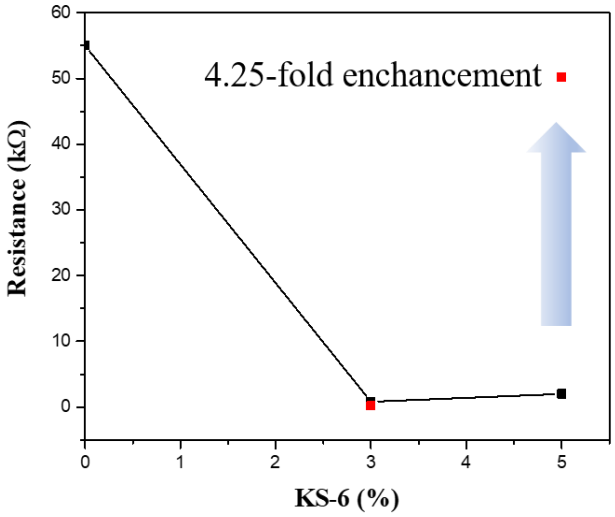

Fig. S4. Resistances of the composite hydrogels prepared by using different contents of KS-6 (black for original sample; red for self-healing sample).

Reference

[S1] C. Qian, T. Higashigaki, T.-A. Asoh and H. Uyama, *ACS Appl. Mater. Interfaces* 2020, **12**, 24, 27518-27525.

[S2] L. J. Van der Pauw, *Phillips Res. Rep.*, 1958, **13**, 1-9.