Electronic Supplementary Material (ESI) for Soft Matter.

Supplementary Information

Rapid preparation of auto-healing gels with actuating behaviour

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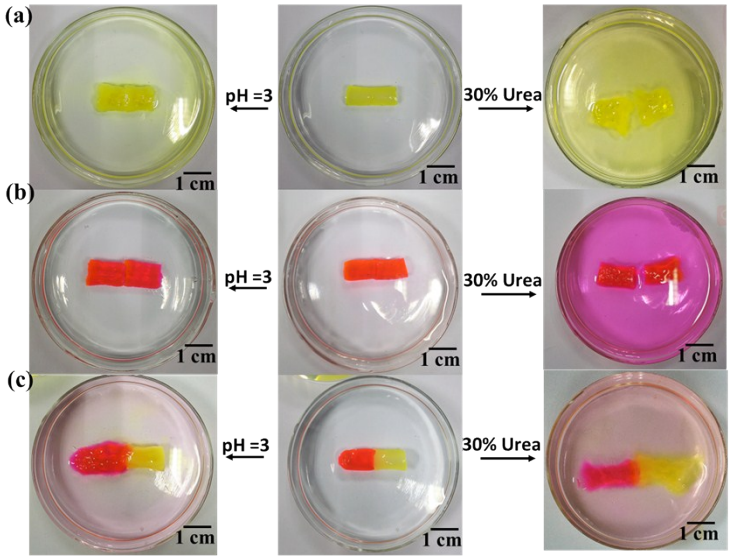

Fig. S1 Self-healed (a) **G-1** and **G-1**, (b) **G-2** and **G-2**, (c) **G-1** and **G-2** were immersed into an aqueous solution of 30% urea and in hydrochloric acid solution (pH=3).

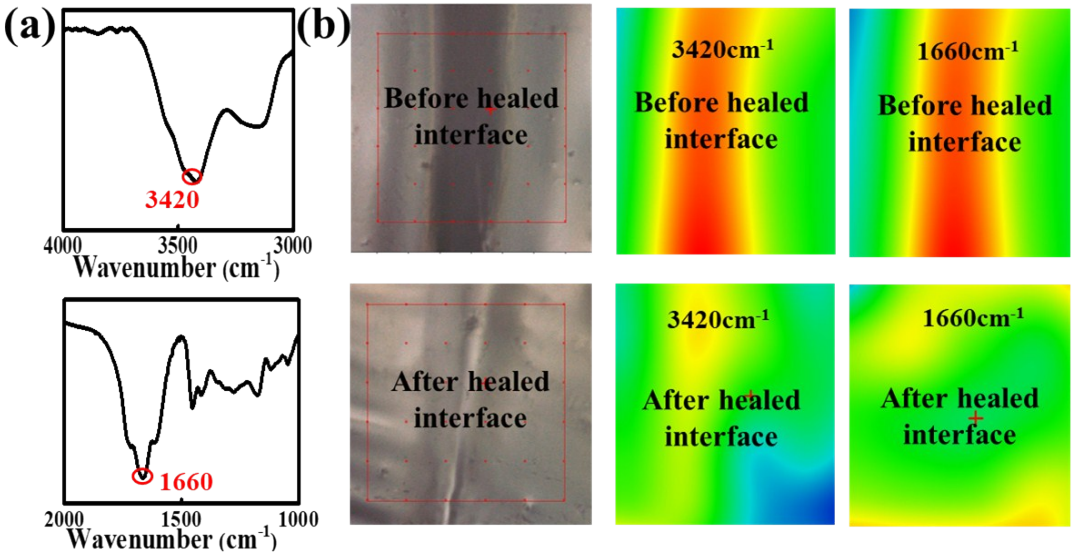

Fig. S2 IR spectra, optical images and IR images of self-healing **G-1** and **G-2** before and after self-healed.

The optical images of microscopic infrared spectroscopy analysis for a biphase **G-1** and **G-2** sample before and after self-healed are shown in Fig. S2. The micro-IR images demonstrate the chemical changes [the distribution of C=O ($1660cm^{-1}$), $–NH_2$ and –OH groups ($3420cm^{-1}$)] through color variation that red color indicates strong intensity while blue color respects weak intensity. Plentiful dangling C=O, $-NH_2$, and –OH groups distribute along the cut area, decreasing as healed. This feature indicates that hydrogen bonds play a key role in self-healing, which enable strong adhesion across the rupture interface and make the gels weld together.

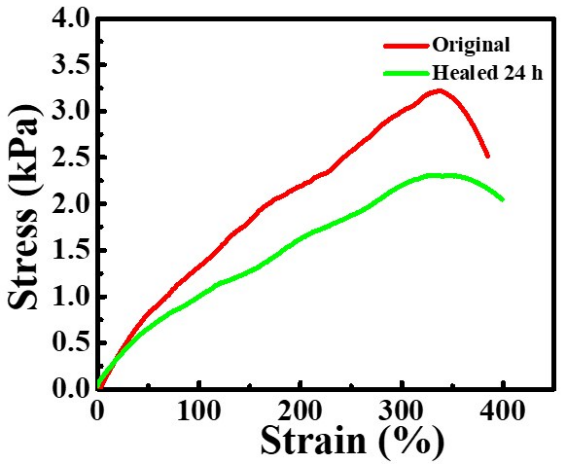

Fig. S3 Strain-stress curves of biphase **G-1** and **G-2** gels: the original sample (red) and healed sample (green).

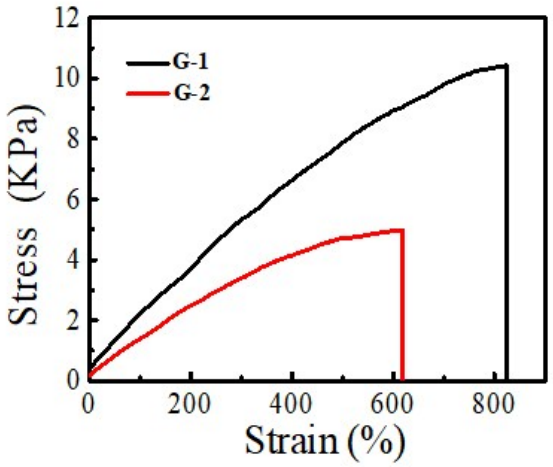

Fig. S4 Strain-stress curves of **G-1** gels and **G-2** gels.

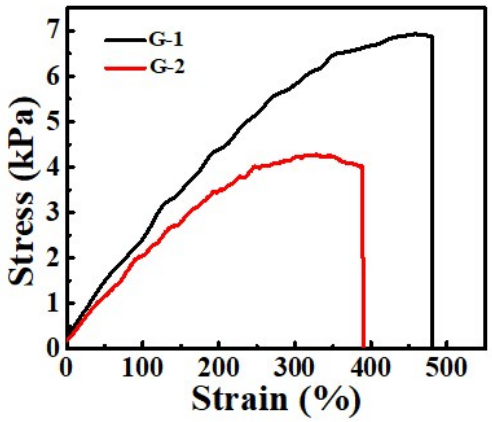

Fig. S5 Strain-stress curves of **G-1** gels and **G-2** gels in an aqueous solution of pH = 7, respectively.

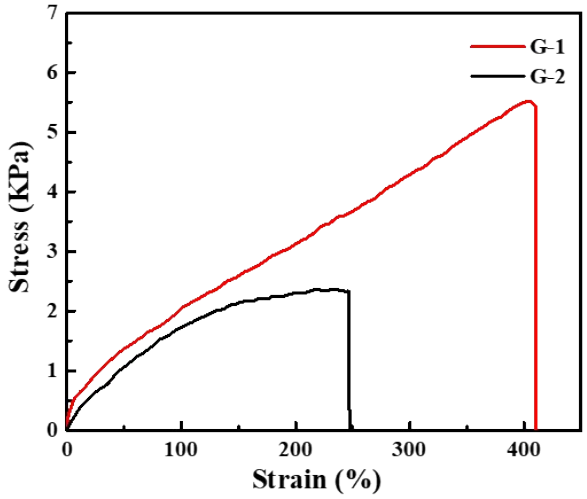

Fig. S6 Strain-stress curves of **G-1** sample and **G-2** sample in an aqueous solution of pH = 9, respectively.

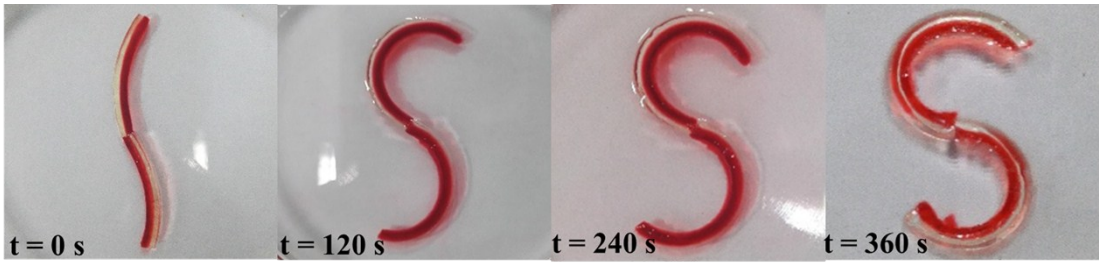

Fig. S7 Actuation of the bilayer gels in NMP solvent.