

## Electronic Supplementary Information

for

### Co-cross-linked Lanthanide-containing Nanocomposite Luminescent Hydrogel

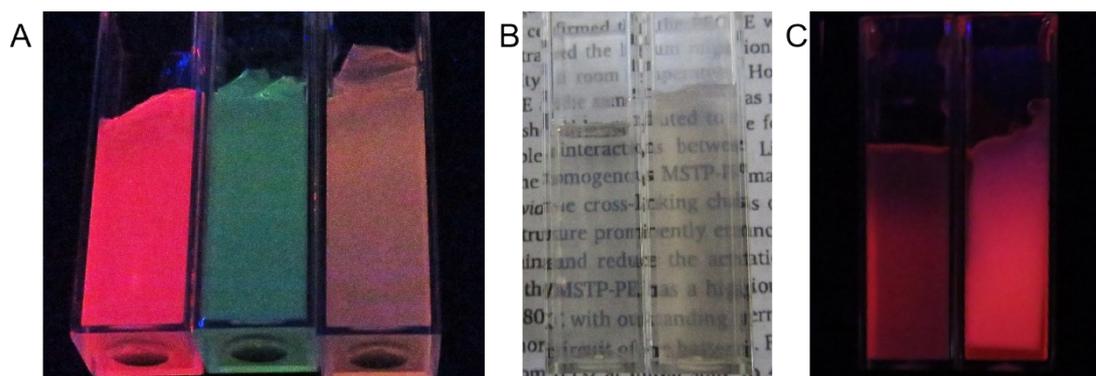
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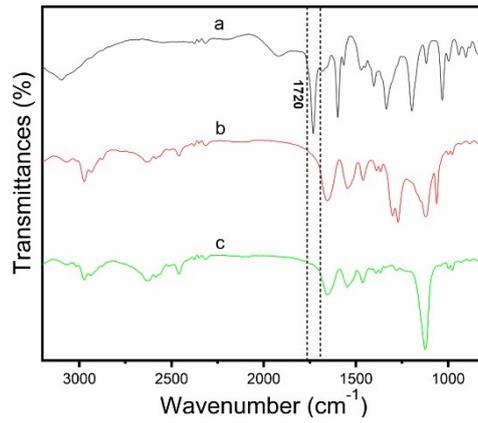
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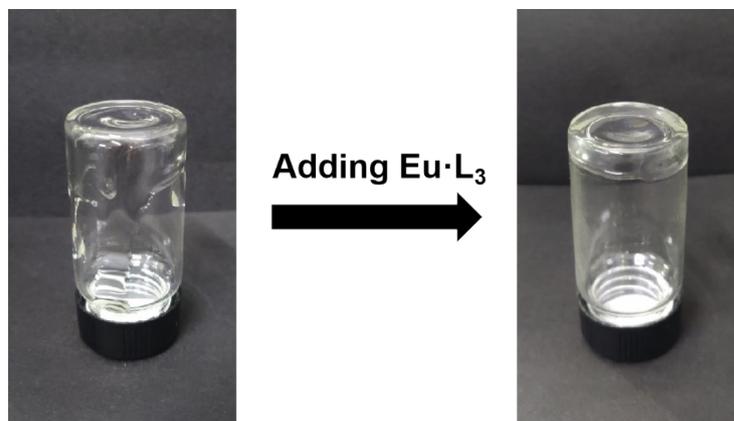
<sup>c</sup>Inner Mongolia Yitai Coal Based New Materials Research Institute Co., Ltd., High Tech Industrial Park, Ordos, 010700, PR China.



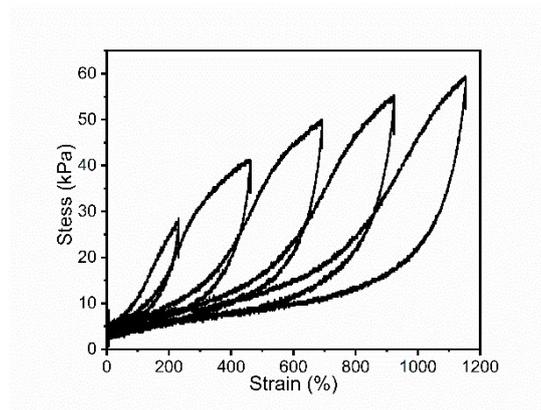
**Fig. S1** (A) The digital photos of NC-Eu·L<sub>3</sub> (red), NC-Tb·L<sub>3</sub> (green), NC-Eu<sub>0.5</sub>Tb<sub>0.5</sub>·L<sub>3</sub> (yellow) hydrogels under the UV light; (B) The image of NC hydrogel (left) and NC-Eu·L<sub>3</sub> hydrogel (right) under daylight. (C) The image of NC hydrogel at 25 °C (left) and 50 °C (right) under the UV light.



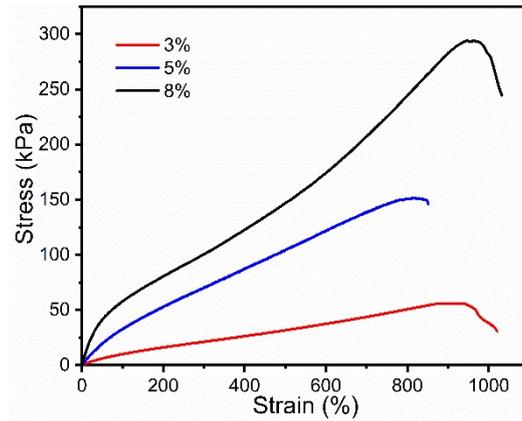
**Fig. S2** FT-IR spectra of L (a), PNIPa-Eu·L<sub>3</sub> (b) and PNIPa-Tb·L<sub>3</sub> (c).



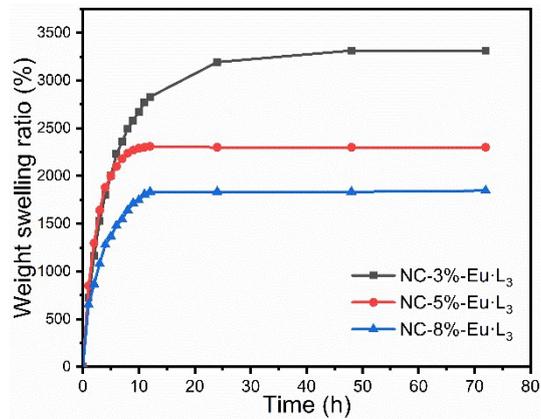
**Fig. S3** The digital photos of 100 g/L NIPA (left) and 100 g/L NIPA with 5 mM Eu·L<sub>3</sub> (right) after polymerization.



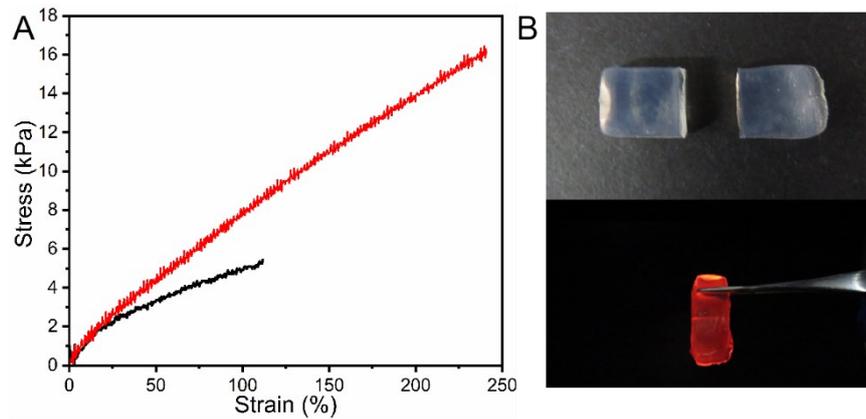
**Fig. S4** The cyclic tensile stress-strain curves of the NC-Eu·L<sub>3</sub> hydrogel. The maximum stretch length is gradually increased from 200% to 1100%.



**Fig. S5** Tensile stress-strain curves of the NC-3%-Eu·L<sub>3</sub>, NC-5%-Eu·L<sub>3</sub> and NC-8%-Eu·L<sub>3</sub> luminescent hydrogel.



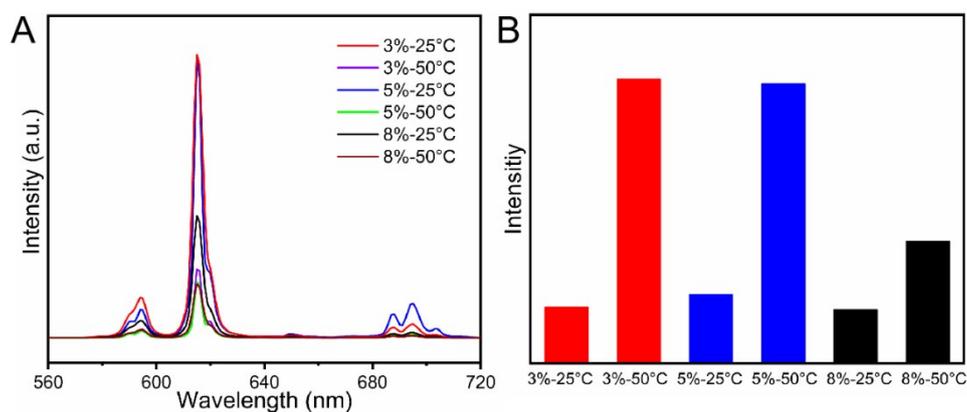
**Fig. S6** Swelling ratios of NC hydrogels with different contents of clay.



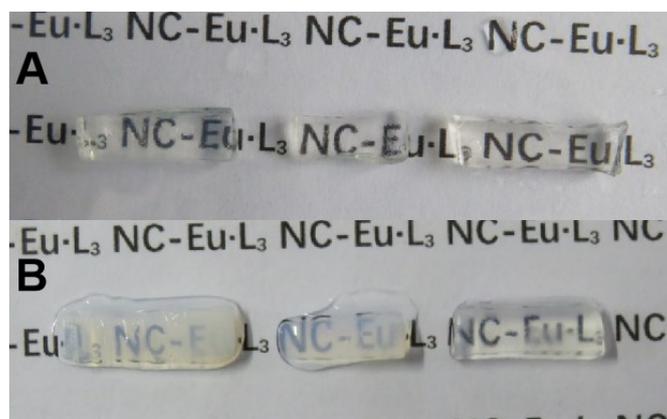
**Fig. S7** (A) Tensile stress-strain of original (red) and self-healed NC-Eu·L<sub>3</sub> hydrogels(black). (B) The self-healed hydrogel under UV lamp.



**Fig. S8** The luminance variation of LED during self-healing processes.



**Fig. S9** (A) The luminescent emission spectra of the hydrogels with different concentration of Lap at 25 °C and 50 °C. (B) The luminescent intensity of the hydrogel with different concentration of Lap at 615 nm.



**Fig. S10** The digital photos of NC-3%-Eu-L<sub>3</sub> (left), NC-5%-Eu-L<sub>3</sub> (middle), NC-8%-Eu-L<sub>3</sub> (right) hydrogels at 25 °C (A) and 50 °C (B).

**Supporting Video S1**

This movie shows the continuous elongation of the NC-Ln-L<sub>3</sub> hydrogel and the elongation at break is as high as 1000%

**Supporting Video S2**

This movie shows the Luminance variation of LED during stretching processes.