Supporting Information

**Thermosensitive Hydrogel-based, High Performance and Flexible Sensor for Multi-functional E-skin**

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Fig. S1. (a) Temperature-sweep rheology data for Ni$_{60}$Am$_{40}$La$_{2.4}$GO$_{0.6}$B$_{0.01}$. (b) $G'$ and $\nuPTT$ values vs. BIS content for the hydrogels from (a).

Fig. S2. Temperature-dependent swelling ratio ($Q$) of Am$_{100}$La$_{2.4}$GO$_{0.6}$B$_{0.01}$, Ni$_{60}$Am$_{40}$La$_{2.4}$GO$_{0.6}$B$_{0.01}$ and Ni$_{100}$La$_{2.4}$GO$_{0.6}$B$_{0.01}$. 
**Fig. S3.** FTIR spectrum of GO, laponite, Ni$_{60}$Am$_{40}$GO$_{0.6}$B$_{0.01}$ and Ni$_{60}$Am$_{40}$La$_{2.4}$GO$_{0.6}$B$_{0.01}$.

**Fig. S4.** Images of GO dispersion (a) and mixture of GO and laponite (b) settled after 6 hours and over than a month.
**Fig. S5.** SEM images of \( \text{Ni}_{60}\text{Am}_{40}\text{B}_{0.01} \), \( \text{Ni}_{60}\text{Am}_{40}\text{GO}_{0.6}\text{B}_{0.01} \), \( \text{Ni}_{60}\text{Am}_{40}\text{La}_{2.4}\text{B}_{0.01} \) and \( \text{Ni}_{60}\text{Am}_{40}\text{La}_{2.4}\text{GO}_{0.6}\text{B}_{0.01} \). The scale bar in (a) is 50\( \mu \)m and applied to all images.

**Fig. S6.** (a) Tissue adhesiveness of the \( \text{Ni}_{60}\text{Am}_{40}\text{La}_{2.4}\text{GO}_{0.6}\text{B}_{0.01} \) hydrogel on the author’s hand. (b) The adhesive curve of hydrogel to different substrates (glass, PTFE, plastic, paper, stainless steel (SS) and pig skin). All data were measured at 25 \(^\circ\)C.
Fig. S7. (a) Rheological strain and (b) dynamic alternating strain-time sweeping measurements of the Ni_{60}Am_{40}La_{2.4}GO_{0.6}B_{0.01}. (c) the change of $G'$ value and tan $\delta$ Ni_{60}Am_{40}La_{2.4}GO_{0.6}B_{0.01} with cyclic alternating strain between 1000% and 1%.

Fig. S8. Conductivity of Ni$_x$Am$_y$La$_z$GO$_n$B$_s$ at 25 °C
Fig. S9. Comparison of $GF$ and conductivity of $\text{Ni}_{60}\text{Am}_{40}\text{La}_{2.4}\text{GO}_{0.6}\text{B}_{0.01}$ to reported hydrogels sensor. The detailed data was listed in Table S1.

Fig. S10. Time-dependent of current for putting the $\text{Ni}_{60}\text{Am}_{40}\text{La}_{2.4}\text{GO}_{0.6}\text{B}_{0.01}$ hydrogel from $10^\circ\text{C}$ to $60^\circ\text{C}$ reversely. The former three cycle was changing the external temperature from $10^\circ\text{C}$ to $60^\circ\text{C}$ (or from $60^\circ\text{C}$ to $10^\circ\text{C}$) and kept for 200 s. The latter three cycle is kept for 80 s.
**Fig. S11.** Re-cyclic test of Resistance changes for Ni$_{60}$Am$_{40}$La$_{2.4}$GO$_{0.6}$B$_{0.01}$ at 10°C and 60°C.

**Fig. S12.** Resistance changes vs. temperature for Ni$_{100}$GO$_{0.6}$La$_{2.4}$B$_{0.01}$ and Am$_{100}$GO$_{0.6}$La$_{2.4}$B$_{0.01}$.

**Fig. S13.** (a) The conductive responses and (b) images of the hydrogel when cutting and self-healing (c) Real-time relative resistance changes of the self-healed Ni$_{60}$Am$_{40}$La$_{2.4}$GO$_{0.6}$B$_{0.01}$ under different strains.
Fig. S14. (a) Live/Dead cell assay and (b) cell viability calculated from MTT assay for the 
$\text{Ni}_{60}\text{Am}_{40}\text{La}_{2.4}\text{GO}_{0.6}\text{B}_{0.01}$ gel. The control is the PBS solution. The scale bar in (a) is 100 μm.

Fig. S15. Finger bending at 30°, 60° and 90°.
Fig. S16. Real-time relative resistance changes of “A”, “B”, “C”, “D” and “1”, “2”, “3”, “4” in the same handwriting.
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<th>Sample Name</th>
<th>Conductivity(mS/cm)</th>
<th>$GF$</th>
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<td>Ni$<em>{60}$Am$</em>{40}$La$<em>{2.4}$GO$</em>{0.6}$B$_{0.01}$</td>
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<td>This Work</td>
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Reference


