Electronic Supplementary Information for

Comparative assessment of the strain-sensing behaviors in polylactic acid nanocomposites: reduced graphene oxide or carbon nanotubes

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**Fig. S1** The set-up for the strain sensing behaviors test (the blue arrows represent the tensile direction; the green lines represent the silver paste electrodes).

**Fig. S2** Image of specimen setup for strain-sensing test used in the present paper (two layers of insulating gaskets were fixed on the surfaces of the tensile fixture).
Strain-sensing behavior measurement for RGO/PLA nanocomposites: (a) 0.3-RGO/PLA, (b) 0.8-RGO/PLA.

Samples with different RGO concentrations are tested in 10 extension-retention cycles to 3% strain. (The original resistances of 0.3-RGO/PLA and 0.8-RGO/PLA in this experiment were $5.31 \times 10^{-5}$ S/m and $3.57 \times 10^{-2}$ S/m, respectively). It can be seen from Fig. S3 that the values of max and min $\Delta R/R_0$ increased gradually with increasing the cycle number for both 0.3-RGO/PLA and 0.8-RGO/PLA nanocomposites. Low RGO concentrations (0.3-RGO/PLA), close to the percolation threshold leads to higher values of max and min $\Delta R/R_0$, as shown in Fig S3a; while high loading of RGO (0.8-RGO/PLA) gives slightly lower values of max and min $\Delta R/R_0$, the responsive curve tends to be more stable in comparison with 0.3-RGO/PLA nanocomposites, as shown in Fig. S3b.

Strain-sensing behavior measurement for CNTs/PLA nanocomposites: (a) 1.2-CNTs/PLA, (b) 1.6-CNTs/PLA.

Samples with different CNTs concentrations are tested in 10 extension-retention cycles to 3% strain. (The original resistances of 1.2-CNTs/PLA and 1.6-CNTs/PLA in this experiment were $2.67 \times 10^{-5}$ S/m and $2.78 \times 10^{-2}$ S/m, respectively). It can be seen from Fig. S4 that the values of max and min $\Delta R/R_0$ increased gradually with increasing the cycle number for both 1.2-CNTs/PLA and 1.6-CNTs/PLA nanocomposites. Low CNTs concentrations (1.2-CNTs/PLA), close to the percolation threshold leads to higher values of max and min $\Delta R/R_0$, as shown in Fig S4a; while high loading of CNTs (1.6-CNTs/PLA) gives slightly lower values of max and min $\Delta R/R_0$, the responsive curve tends to be more stable in comparison with 1.2-CNTs/PLA nanocomposites, as shown in Fig. S4b.
strain. (The original resistances of 1.2-CNTs/PLA and 1.6-CNTs/PLA in this experiment were \(4.05 \times 10^{-3}\) S/m and \(6.31 \times 10^{-2}\) S/m, respectively). It can be seen from Fig. S4 that values of max and min \(\Delta R/R_0\) became more and more negative with increasing the cycle number for both 1.2-CNTs/PLA and 1.6-CNTs/PLA nanocomposites. However, it is worth noting that the strain sensing behavior of 1.6-CNTs/PLA exhibits a stable response compared with composites containing 1 wt% CNTs and 1.2 wt% CNTs, which is attributed to the formation of a stable conductive network.

Table S1.

The changes of max and min \(\Delta R/R_0\) values of 0.5-RGO/PLA and 1.0-CNTs/PLA nanocomposites during 10 cycles.

<table>
<thead>
<tr>
<th>Cycle number</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGO/PLA</td>
<td>Max (\Delta R/R_0)</td>
<td>0.049</td>
<td>0.046</td>
<td>0.059</td>
<td>0.068</td>
<td>0.069</td>
</tr>
<tr>
<td></td>
<td>Min (\Delta R/R_0)</td>
<td>0.012</td>
<td>0.016</td>
<td>0.025</td>
<td>0.034</td>
<td>0.040</td>
</tr>
<tr>
<td>CNTs/PLA</td>
<td>Max (\Delta R/R_0)</td>
<td>0.063</td>
<td>0.038</td>
<td>0.029</td>
<td>0.024</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td>Min (\Delta R/R_0)</td>
<td>-0.019</td>
<td>-0.029</td>
<td>-0.029</td>
<td>-0.034</td>
<td>-0.038</td>
</tr>
</tbody>
</table>

The max and min \(\Delta R/R_0\) values of 0.5-RGO/PLA and 1.0-CNTs/PLA nanocomposites during 10 cycles are shown in table S1. For RGO/PLA nanocomposites, the max \(\Delta R/R_0\) value in the tenth cycle increases to 0.074 from 0.049 in the first cycle, meanwhile the min \(\Delta R/R_0\) value in the tenth cycle increases to 0.044 from 0.012 in the first cycle. Contrarily, for CNTs/PLA nanocomposites, the max \(\Delta R/R_0\) value in the tenth cycle decreases to 0.014 from 0.063 in the first cycle, and the min \(\Delta R/R_0\) value in the tenth cycle decreases to -0.043 from -0.019 in the first cycle.