High-adhesion Vertically Aligned Gold Nanowire Stretchable Electrodes via a Thin-Layer Soft Nailing Strategy

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Figure S1 The schematic illustration of percolation models and contact situation between (a) printed nanowires and (b) the v-AuNWs.
Figure S2 SEM images of PS microsphere and pinhole v-AuNWs array. (a-g) Top view and (h-n) Cross-section view of PS microspheres array heated at 110°C for 0 s, 5 s, 10 s, 15 s, 30 s, 60 s and 120 s, respectively. (o-u) SEM images of pinhole v-AuNWs film when PS microspheres were heated for 0 s, 5 s, 10 s, 15 s, 30 s, 60 s and 120 s, respectively.
Figure S3. AFM images before (a) and after (b) PDMS casting.
Figure S4 (a) The fabrication process of embedded pinhole stretchable microelectrode. (b) Optical photographs of microelectrode. (c) Optical microscopic image of microelectrode. The width is calculated to be 300 μm; (d) The SEM image of selective area in figure c.
Figure S5 SEM images of v-AuNWs on silicon wafer grown for different incubation times in the growth solution.
Figure S6 Top-view SEM images for pinhole v-AuNWs film with different PS microspheres diameter (all scale bars are 10 μm): (A) 2 μm; (B) 3 μm and (C) 4.5 μm. Heating time was controlled at 10 S.
Figure S7 Comparison between sheet resistance and transmittance versus different pinhole diameters. The AuNW growth times were held constantly at 3 min.
Figure S8 SEM images of pinhole v-AuNWs/PDMS electrode under elongation/relaxation processes. (a) Initial status, scale bar: 5 μm. (b) 40% strain, scale bar: 5 μm. (c) Release of stain, scale bar: 5 μm. (d) The cross-section view under 40% stain, scale bar: 1 μm.
Fig. S9 The durability test under a strain of 40% for 1000 cycles
Figure S10 (a) The optical image of monolayer PS microsphere assembled by unidirectional rubbing, sample size: 5 cm × 6 cm; (b) Optical microscopic image of monolayer PS microsphere. Inset: Diffraction pattern obtained by projecting a commercial laser pointer through the monolayer.
Table S1 Statistical data of diameter of melted PS microspheres and diameter of pinholes in v-AuNWs film at different heating time.

<table>
<thead>
<tr>
<th>Melting time</th>
<th>0 s</th>
<th>5 s</th>
<th>10 s</th>
<th>15 s</th>
<th>30 s</th>
<th>60 s</th>
<th>120 s</th>
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</thead>
<tbody>
<tr>
<td>Diameter of melted PS microsphere area (μm)</td>
<td>0.3±0.1</td>
<td>1.3±0.2</td>
<td>2.0±0.3</td>
<td>2.5±0.4</td>
<td>3.1±0.4</td>
<td>4.2±0.5</td>
<td>4.4±0.5</td>
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<tr>
<td>Diameter of pinhole (μm)</td>
<td>0.4±0.1</td>
<td>1.1±0.2</td>
<td>1.8±0.2</td>
<td>2.3±0.3</td>
<td>2.8±0.4</td>
<td>3.8±0.7</td>
<td>N/A</td>
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</table>