Directly printed stretchable strain sensor based on ring and diamond shaped Silver nanowire electrodes

<Supplementary Information>

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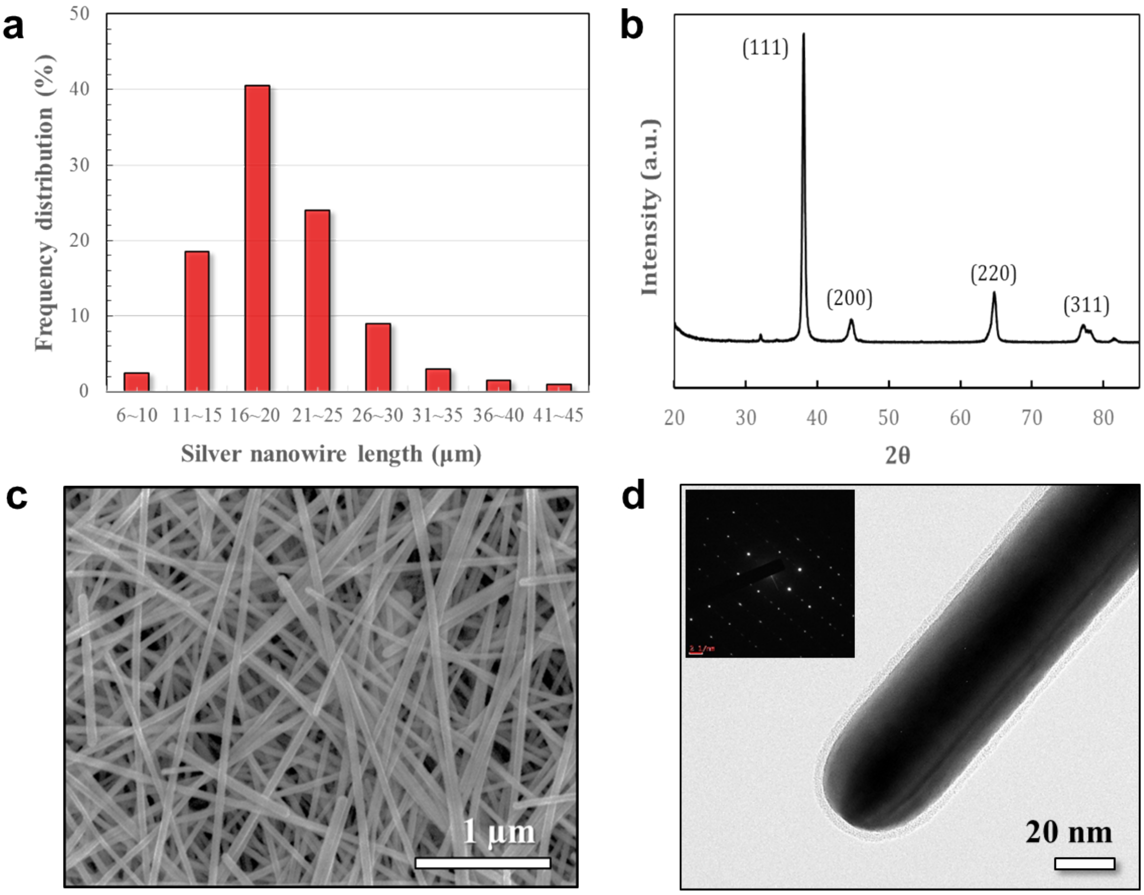
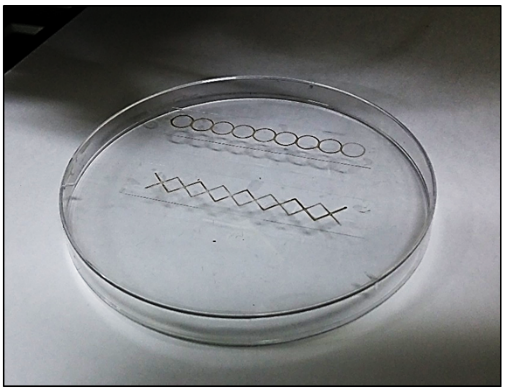


Fig. S1. (a) Silver nanowire length distribution; (b) the typical powder X-ray diffraction pattern of Ag NWs; SEM image of (c) randomly oriented Ag NWs; and (d) TEM image of Ag NW with a SAED pattern (inset)

The SEM image of Ag NWs (Fig. S1c) employed in the experiment showed an average width and length of 40±7 nm and 20±5 μm, respectively, which resulted in an average aspect ratio of 500 (Fig. S1a). To prove the crystallinity and phase of the Ag NWs, we deposited Ag NWs on films by a drop casting method and observed the powder X-ray diffraction (XRD) pattern of the samples (Fig. S1b)). The strongest peaks were obtained at 38.1°, 44.9°, and 64.7°, which means that the diffraction of the crystalline planes of the face-centered cubic (fcc) structure of silver were (111), (200) and (220), respectively. Fig. S1d shows a typical TEM image of a PVP capped single Ag NWs and the corresponding selected area electron diffraction pattern was shown in an inset of Fig. S1d.

a



b

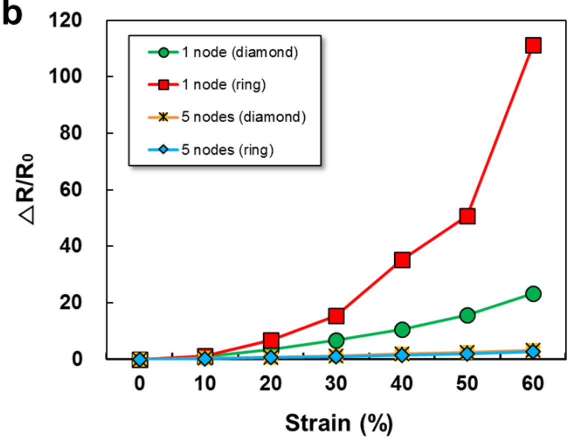


Fig. S2. (a) The printed elastic strain of the conductor with only 1 node; (b) relative resistance change as a function of the applied tensile strain

Fig. S2a shows ring and diamond chain shapes of elastic strain electrodes with 1 node. As shown in Fig. 5, the stress concentration of the diamond shape was significantly focused on the angulate edges, while that of the ring shape was evenly distributed along the rounded edges. In addition, the number of nodes was another factor that enhanced stability. The elastic strain of the conductor with only 1 node was considerably larger than that of the conductor with 5 nodes. This means that the position or alignment change of Ag NWs inside the PDMS elastomer will significantly affect the resistance change, and also the sensitivity of the strain gauge can be increased as shown in Fig. S2b