Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Flexible Conducting Electrodes Based on an Embedded Double-Layer Structure of Gold Ribbons and Silver Nanowires

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1. Preparation of a thin layer and micropatterns of eicosane

A thin layer of eicosane was prepared on Si substrates by spin-coating method at 5000 rpm for 60 sec from its melt at around 40 ^{o}C. Thickness of the resulting layer of eicosane was measured as around 30 μm by surface profiler as seen in Figure S1(a). By micro-contact printing method with elastomeric master stamps, prisms of eicosane were produced on the surface of Si substrates. During the patterning process, the bare surface of Si substrates was also released between two eicosane patterns because the ridge of stamps could contact directly with the surface. The width of the exposed regions was increased with pressurizing times and summarized in Figure S1(b).

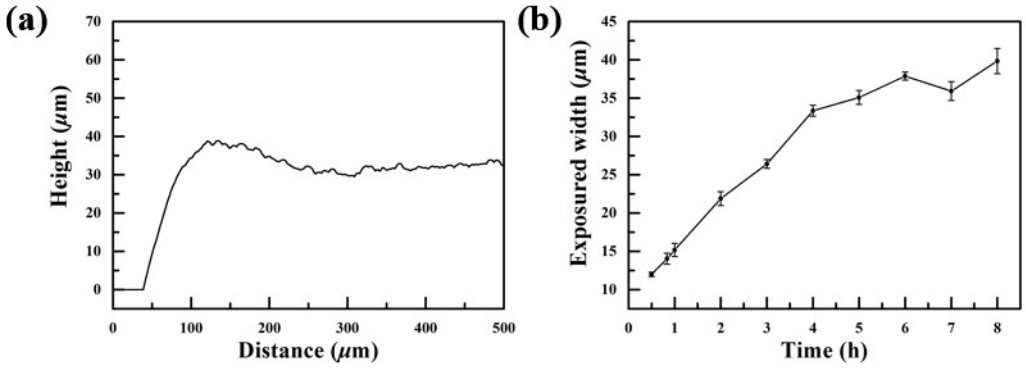

Figure S1. (a) Height of eicosane after spin-coated on silicon wafer. (b) Width changes of exposed surface of Si substrates with increasing pressurizing times.

2. Deposition of gold ribbons via galvanic displacement

To produce prism-shaped or pyramid-shaped patterns of eicosane, the elastomeric stamp was directly put on a thin layer of n-paraffin with weight of 500 g for various times. Then the micropatterns of ecoisane were immersed in the reaction solution for galvanic displacement reaction of gold on the bare surface exposed between two pre-existing patterns of eicosane.

Figure S2(a) shows gold ribbons on a Si substrate after the reaction. Subsequently anisotropic etching process of gold ribbons was carried out in the aqueous solution of hydrogen peroxide (H_2O_2) and hydrofluoric acid (HF), so that they could infiltrate through the Si substrates as seen in Figure S2.

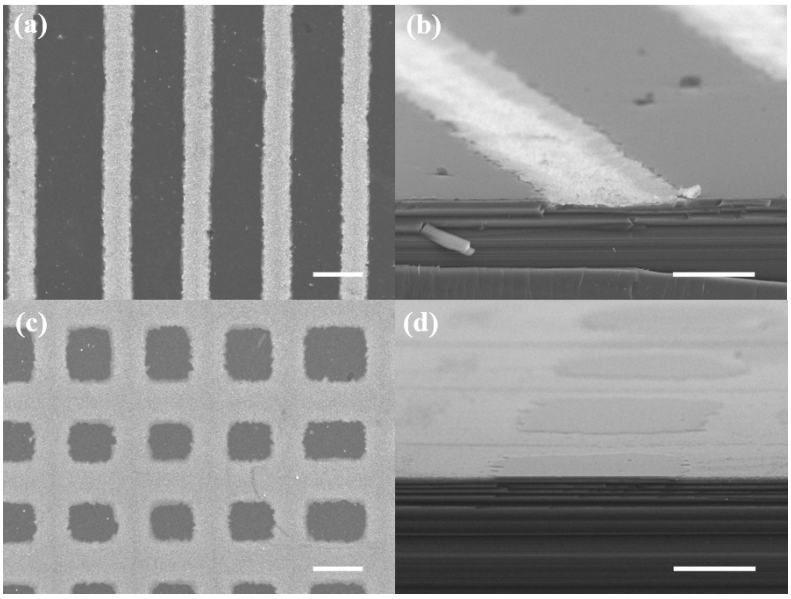

Figure S2. SEM microscope images of etched Au ribbons ((a) top-view and (b) cross-sectional view), and etched Au grids ((c) top-view and (d) cross-sectional view), respectively. (Scale bars of (a) and (c) are 30 μm and scale bars of (b) and (d) are 10 μm.)

Figure S3(a) shows surface profile of gold ribbons deposited on Si substrate via galvanic displacement and clearly indicates their periodic structures. However, after the anisotropic etching, all gold ribbons successfully infiltrated into the Si substrate as seen in Figure S3(b).

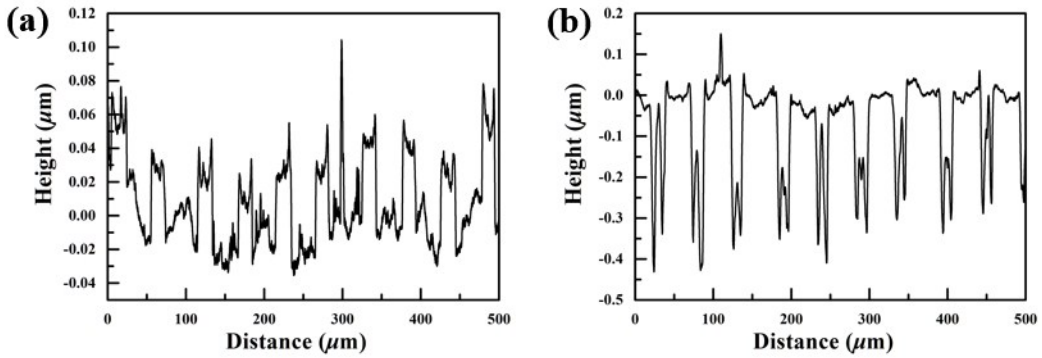

Figure S3. Surface profiles of (a) Au ribbons on silicon wafer deposited from 50 mM $HAuCl_4$ solution for 3 minutes and (b) embedded Au ribbons from H_2O_2 solution for 5 minutes.

3. X-ray diffraction (XRD) measurement of silver nanowires

Silver nanowires (Ag NWs) used in this study was synthesized by using typical polyol method and suspended in methanol. In order to characterize the Ag NWs, X-ray diffraction (XRD, Rigaku Co. Ultima IV) with Cu Kα radiation (λ = 1.5406 $Å^{-1}$) was utilized. For the XRD measurement, the suspended Ag NWs were drop-casted on Si substrates. Figure S4 displays X-ray diffraction patterns of the Ag NWs synthesized in this study. This patterns were taken by scanning 2 theta angles from 20 to 90 degrees. As a result, we observed the

five characteristic peaks which were (111), (200), (220), (311), and (222) planes in face-centered cubic (FCC) phase of the Ag NWs.

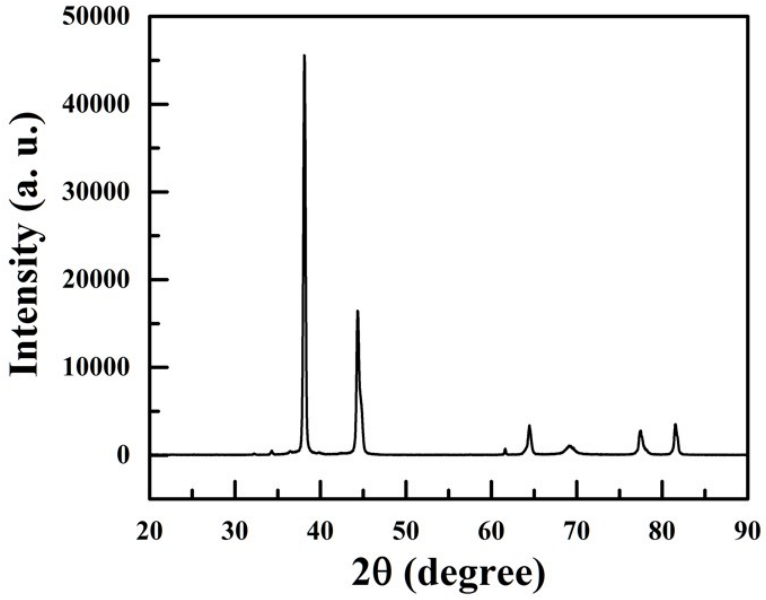

Figure S4. X-ray diffraction pattern of Ag NW on Si (100) wafer.