SUPPLEMENTARY INFORMATION

Free-standing nanofibrous platinum sheets and their conductivity

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1. Deposition of thin platinum layers

Formation of cadmium hydroxide nanostrands has been reported in reference 17, in which the nanostrands were prepared by mixing aqueous solutions of cadmium nitrate and sodium hydroxide. In the present report, we used aqueous cadmium chloride and very dilute 2-aminoethanol solutions. This combination was better than the previous one in terms of uniformity of the length of the nanostrands. The aging time of 15 min was enough to yield narrow and rigid nanostrands in a range of a few micrometers. A given volume of the mixed solution was filtered on a polycarbonate (PC) membrane (Nuclepore®, *Whatman*) with pores of 0.2 μm in diameter. Then, the nanostrands gave a uniform ultrathin film covering the porous membrane filter. When the thickness was more than 50 nm, deep cracks occasionally formed on the film during filtration. Cadmium chloride ($CdCl_2 \cdot 2.5H_2O$) and 2-aminoethanol were purchased from Kanto Chemical.

Platinum deposition was conducted by using a Hitachi e-1030 ion sputter at the pressure of 10 Pa and the current density of 10 mA. The thickness was controlled by the selection of deposition time, and was estimated independently by means of quartz crystal microbalance technique and from the observation using a high resolution TEM.

2. Sheet resistance and other measurements

In order to characterize Pt-coated nanostrand sheets by TEM, SEM, SAED, and EDX, we needed to peel off the sheets from a membrane filter. Therefore, the polycarbonate membrane was dissolved in chloroform, and then the Pt-coated nanostrand sheets were collected by centrifugation (10,000 rpm, 10 min). Subsequently, the sheets were treated with 10 mM aqueous hydrochloric acid to remove the cadmium hydroxide nanostrands. The resultant nanofibrous Pt sheets was purified by repeating the centrifugation and washing process in water three times.

On the other hand, sheet resistance was needed to be measured on a polycarbonate membrane filter. In this case, cadmium hydroxide nanostrands were removed by floating the membrane filter with a Pt-coated nanostrand sheet on a 0.5 mM aqueous EDTA solution for two days. Subsequently, the membrane filter was floated on pure water for a few hours and dried in the air. The removal of cadmium hydroxide nanostrands was confirmed by EDX measurements.

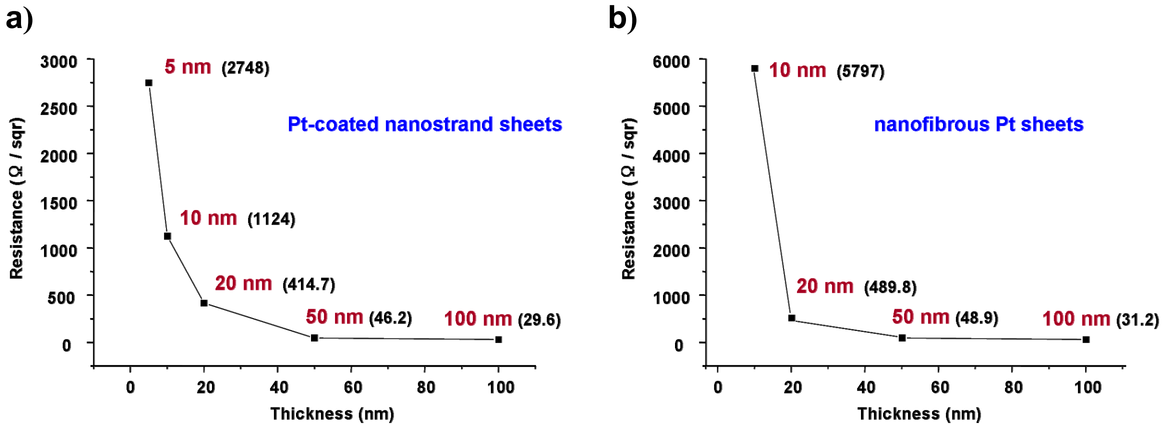

Figure S1. Thickness-dependent resistance of Pt-coated nanostrand sheets (**a**) and nanofibrous Pt sheets (**b**).

Figure S1 shows changes of the sheet resistance of Pt-coated nanostrand and nanofibrous Pt sheets with their thicknesses (these data are same as Table 1). The values of the resistance were obtained by using a four-point probe sheet resistance measurement system (RT-70/RG-7B) manufactured by Napson Corporation. This system has a probe head, in which four tungsten carbide electrodes get lined with a distance of 0.5 mm. The upper limit of the applied voltage is 1.0 V and the lowest current is 1.0 μA.

TEM images and SAED patters were obtained by using a JEOL-1010 at an acceleration voltage of 100 kV. EDX spectra were obtained by JEOL JEM-3000F transmission electron microscope at an acceleration voltage of 300 kV. To prepare the specimens, the ethanolic suspension of Pt-coated nanostrand (or nanofibrous Pt) sheets was spread on a carbon-coated copper TEM grid and allowed to stand in the air until the solvent completely evaporated. FE-SEM images were obtained by using a Hitachi S-4800 at an acceleration voltage of 25 kV.