Supporting Information

Tailoring Carbon Nanotubes Surface with Maleic Anhydride for Highly Dispersed PtRu Nanoparticles and Their Electrocatalytic Oxidation of Methanol

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1. ICP-AES analysis of electrocatalysts

Table S1. The results of ICP-MS for different CNT-based electrocatalysts

Electrocatalysts	Pt (wt. %)	Ru (wt. %)	Atomic ratio of Pt:Ru
PtRu/CNT-C	14.36	4.73	1.57
PtRu/AO-CNT	10.73	4.24	1.31

The composition of the prepared catalysts was determined by ICP-AES. There are 14.36 and 4.73 wt.% of Pt and Ru in PtRu/CNT-C, respectively, whereas 10.73 and 4.24 wt.% of Pt and Ru for PtRu/AO-CNTs, respectively. Note that the loading mass of the PtRu nanoparticles supported on CNT-C is higher than that on AO-CNTs. In addition, the atomic Pt-Ru ratio of PtRu/CNT-C is 1.57, which is slightly higher than that of PtRu/AO-CNT (1.31). It confirms the CNT-C is suitable support to anchor and grow metal nanoparticles.

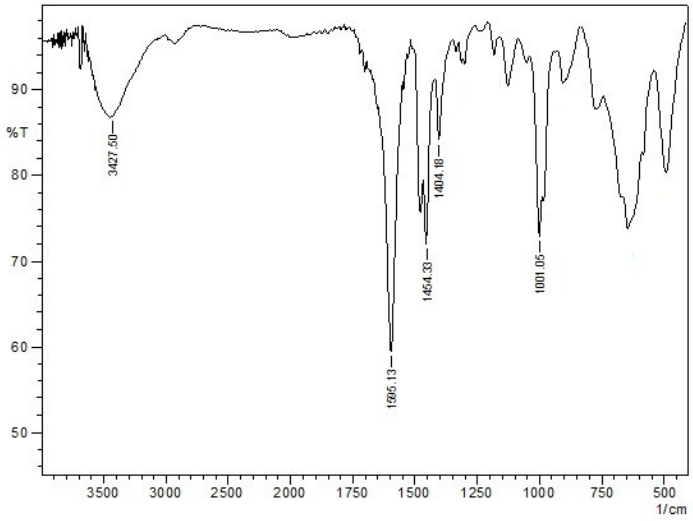

Figure *S1.* FTIR spectra of PtRu/CNT-C.

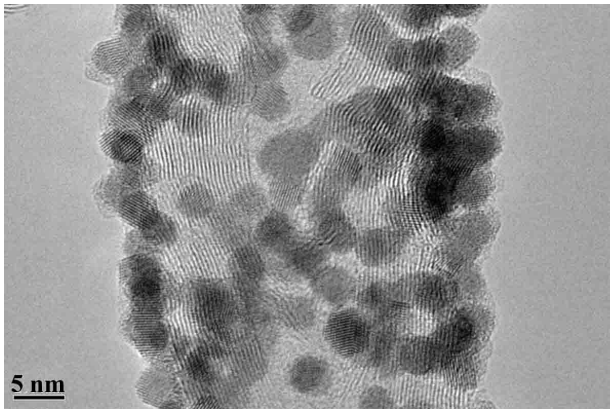

Figure *S2* TEM images of PtRu/CNT-C nanohybrids.

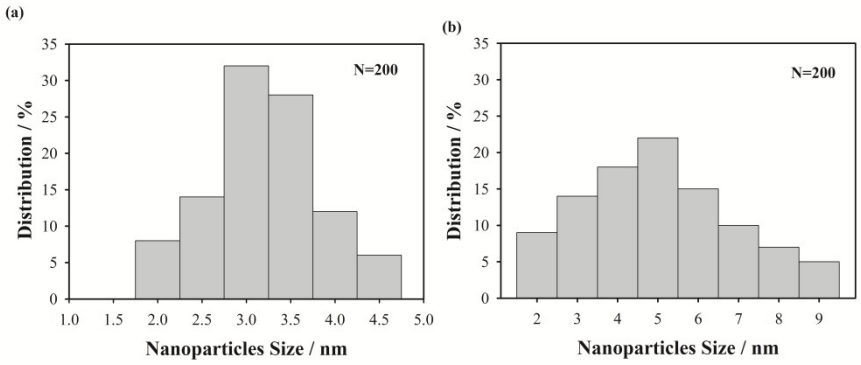

Figure *S3*. Size distribution of PtRu nanoparticles of PtRu/CNT-C (a) and PtRu/AO-CNT (b) nanohybrids.

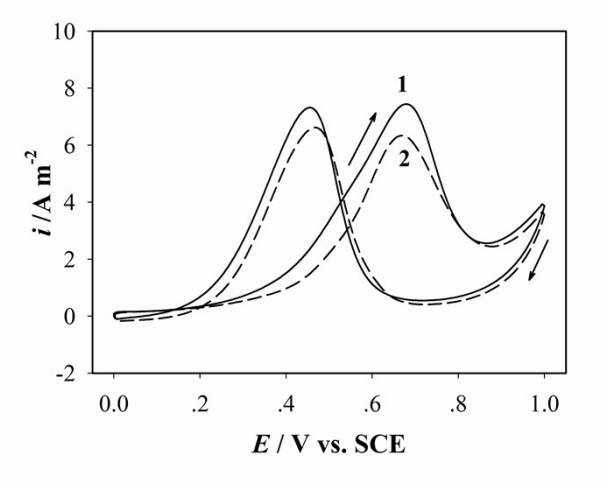

Figure *S4*. Cyclic voltammograms (specific activity) of PtRu/CNT-C (1) and PtRu/AO-CNT (2) nanohybrids in nitrogen-saturated 0.5 M H_2SO_4 + 1.0 M CH_3OH aqueous solution at a scan rate of 50 mVs^{-1}.

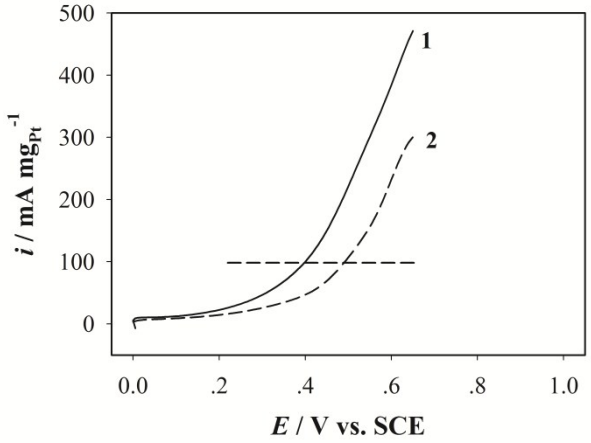

Figure *S5*. Linear sweep voltammetry of PtRu/CNT-C (1) and PtRu/AO-CNT (2) nanohybrids in nitrogen-saturated 0.5 M H_2SO_4 + 1.0 M CH_3OH aqueous solution at a scan rate of 50 mVs^{-1}.

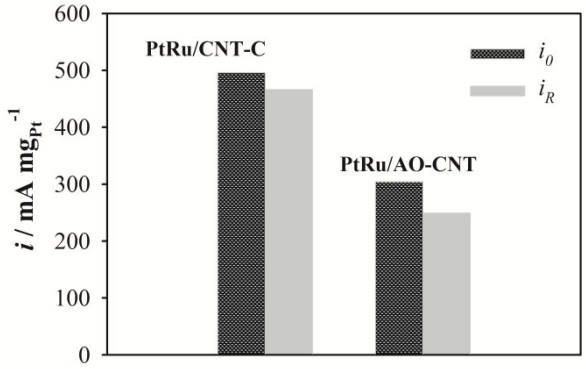

Figure *S6* Comparison of the forward peak current at the first cycle (i_0) and recovery forward peak current (i_R) in the fresh methanol solution after long-term cyclic voltammograms scanning experiments (600 cycles) on PtRu/CNT-C and PtRu/AO-CNT nanohybrids