Supporting Information for

Pt/Ru/C Nanocomposites for Methanol Electrooxidation: How RuNanocrystals' Surface Structure Affects Catalytic Performance of Deposited Pt Particles

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Preparation of the mixed catalysts of commercial Pt/C and Ru NCs.

50 μL of the ethanol dispersion of commercial Pt/C with a concentration of 1 mg/mL and 50 μL of the ethanol dispersion of Ru nanocrystals (triangular plates (TPs), Ru capped columns or Ru nanospheres (NSs)) containing 5.2 μg Ru were mixed together in a vial, followed by ultrasonic treatment for 15 min. For electrocatalytic tests, 20 μL of the mixed dispersion was dropped on the glassy carbon electrode and dried, followed by the addition of 5 μL of Nafion (0.2 wt% ethanol solution).

Table S1. Ratios of Ru and Pt elements in different valent states obtained from XPS analyses.

	Ru(IV)/Ru(0)	**Pt(IV)/Pt(II)/Pt(0)**
Pt/Ru TPs	21:79	7:33:60
Pt/Ru CCs	17:83	4:41:55
Pt/Ru NSs	40:60	6:30:64

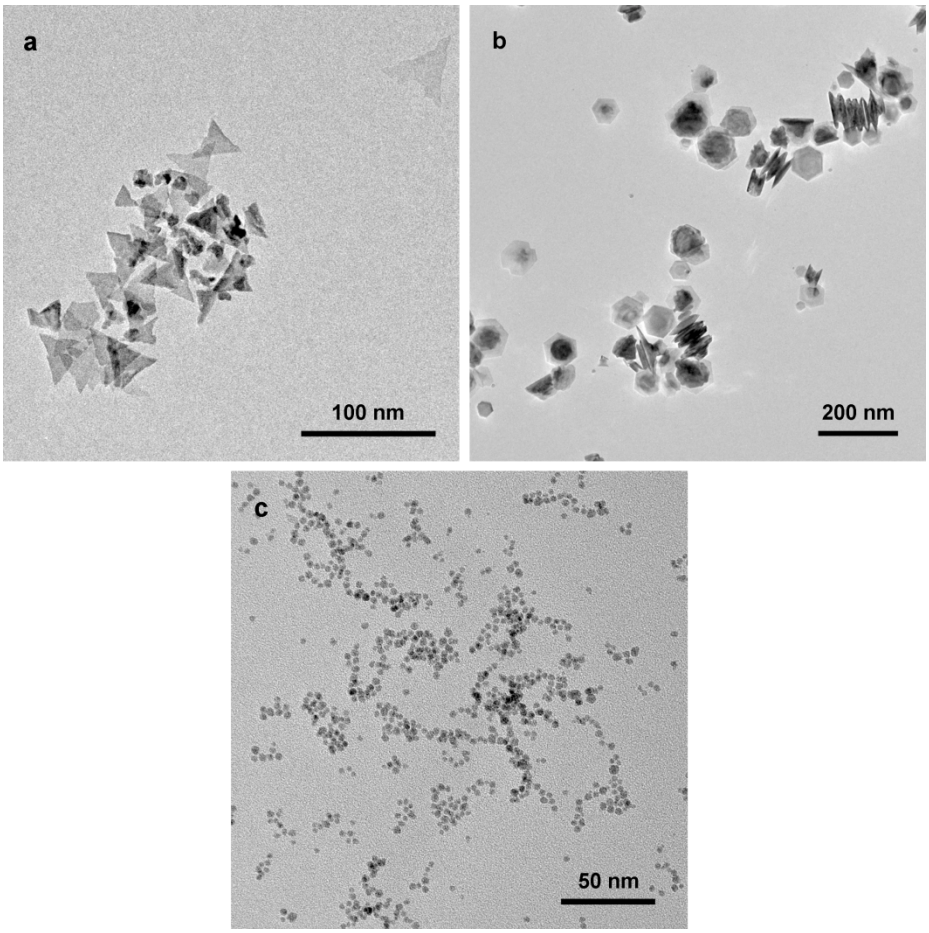

Figure S1. TEM images of (a) Ru TPs, (b) Ru CCs and (c) Ru NSs.

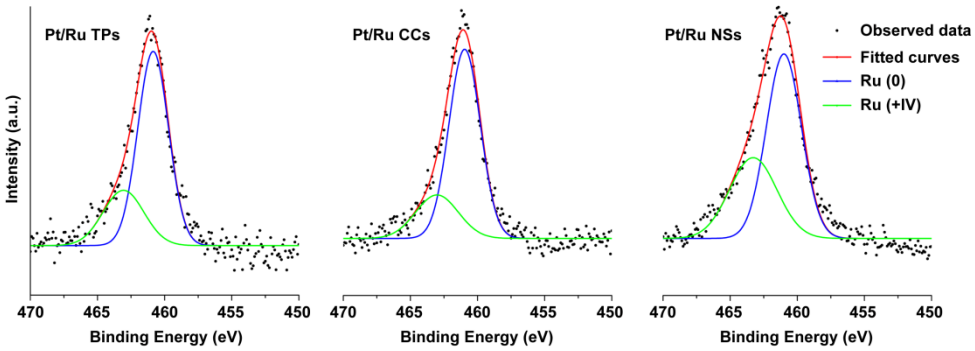

Figure S2. Observed Ru $3p_{3/2}$ photoelectron spectra of Pt/Ru NCs composites compared with fitted data.

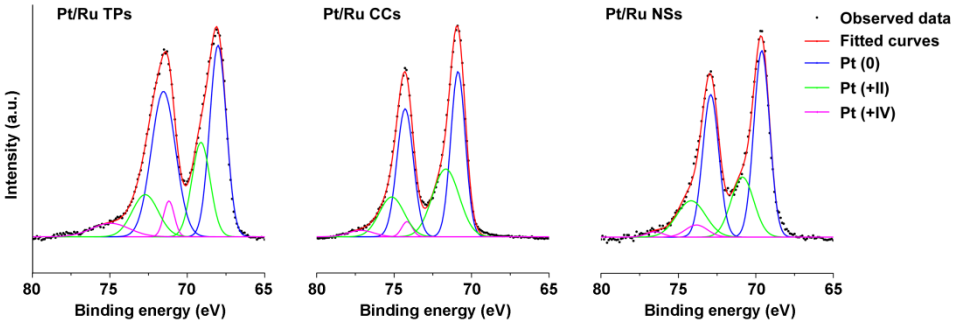

Figure S3. Observed Pt $4f_{5/2}$ and $4f_{7/2}$ photoelectron spectra of Pt/Ru NCs composites compared with fitted data.

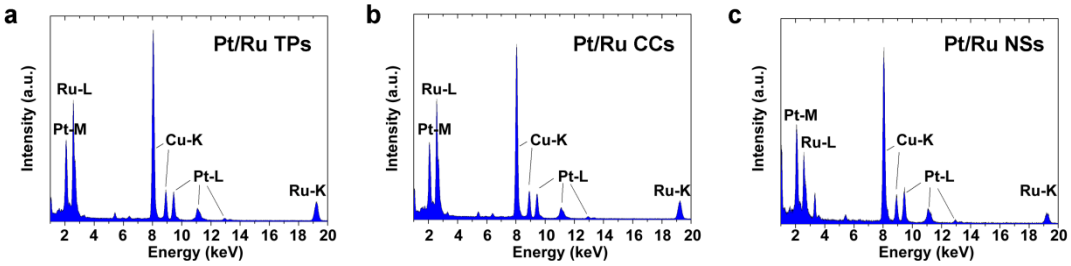

Figure S4. Energy dispersive X-ray spectra of (a) Pt/Ru TPs, (b) Pt/Ru CCs and (c) Pt/Ru NSs.

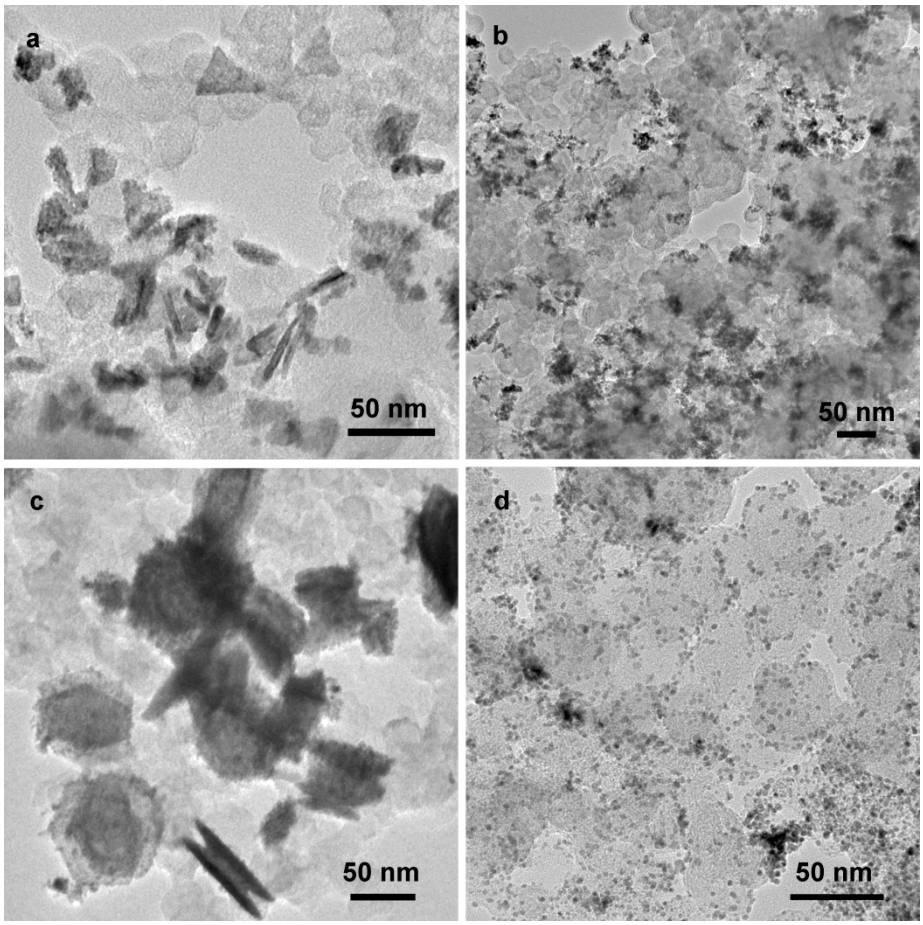

Figure S5. TEM images of (a) Pt/Ru TPs/C, (b) Pt/Ru NSs/C, (c) Pt/Ru CCs/C and (d) commercial Pt/C.

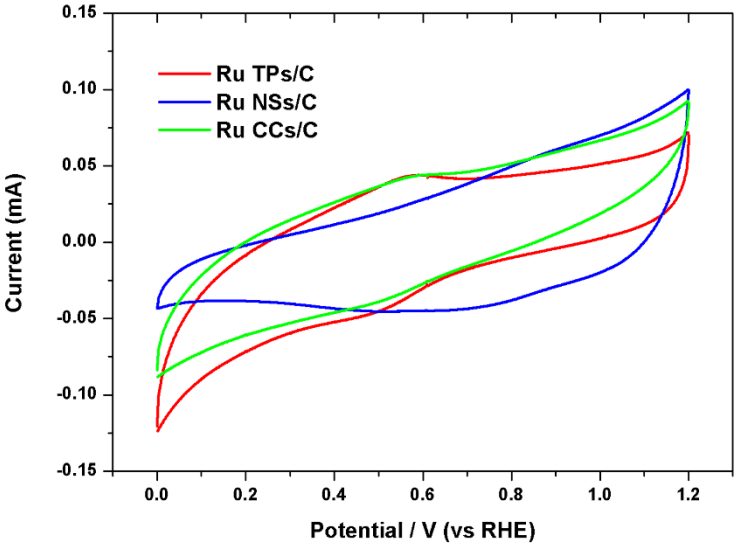

Figure S6.CV curves of Ru TPs/C, Ru NSs/C and Ru CCs/C in 0.1 M $HClO_4$ at the scanning rate of 50 mV/s.

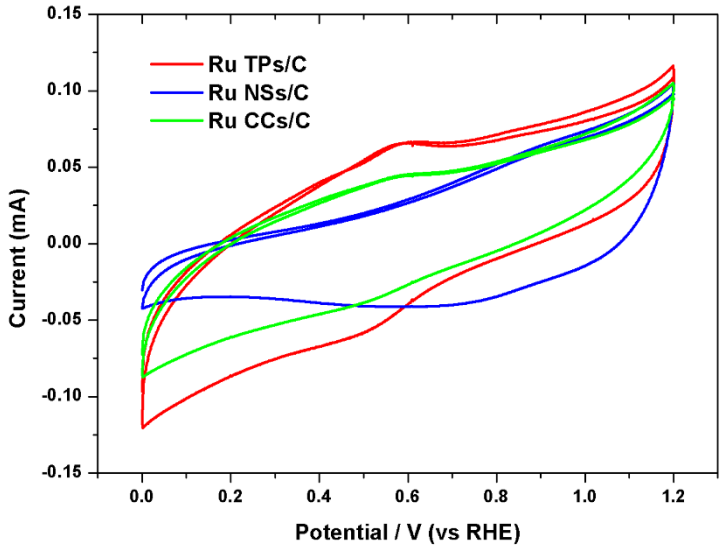

Figure S7. The first cycle and the forward scan of the second cycle of CO stripping tests of Ru TPs/C, Ru NSs/C and Ru CCs/C in 0.1 M $HClO_4$ at the scanning rate of 50 mV/s.

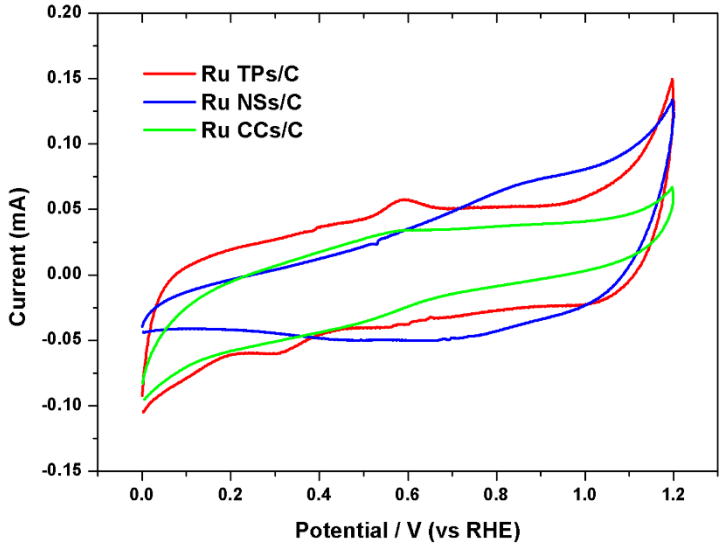

Figure S8. CV curves of Ru TPs/C, Ru NSs/C and Ru CCs/C in 0.1 M $HClO_4$ and 0.1 M MeOH at the scanning rate of 50 mV/s.

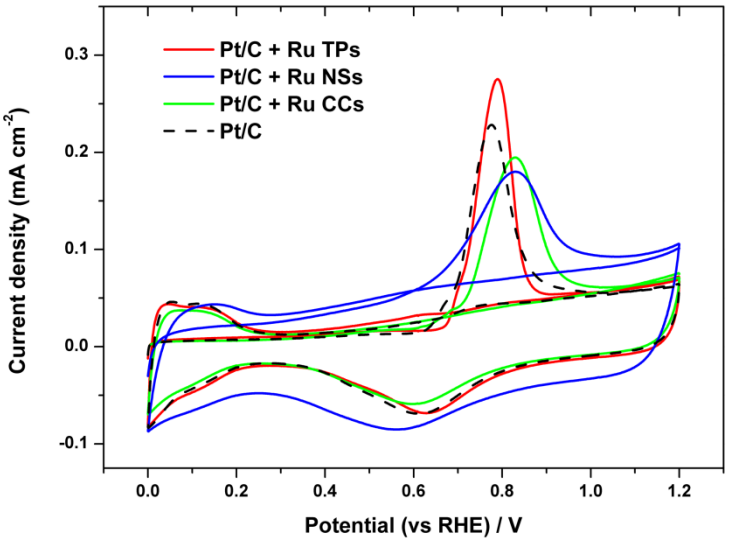

Figure S9. The first cycle and the forward scan of the second cycle of CO stripping tests of the mixtures of Pt/C and Ru NCs in 0.1 M $HClO_4$ at the scanning rate of 50 mV/s.

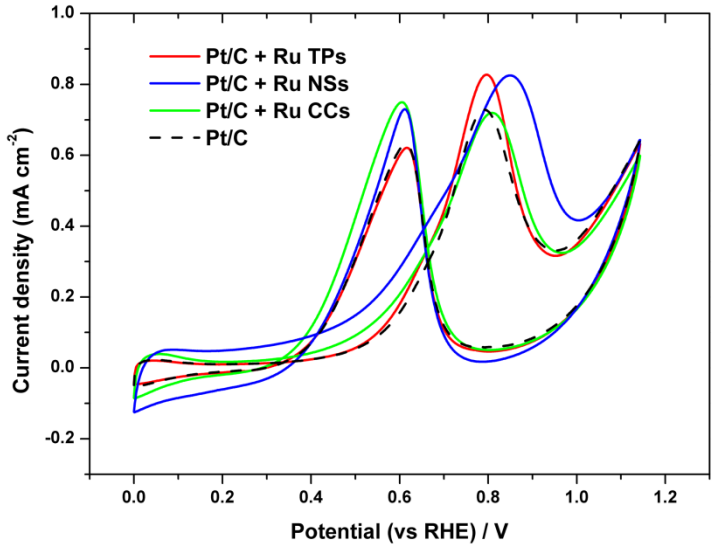

Figure S10. CV curves of the mixtures of Pt/C and Ru NCs in 0.1 M $HClO_4$ and 0.1 M MeOH at the scanning rate of 50 mV/s.

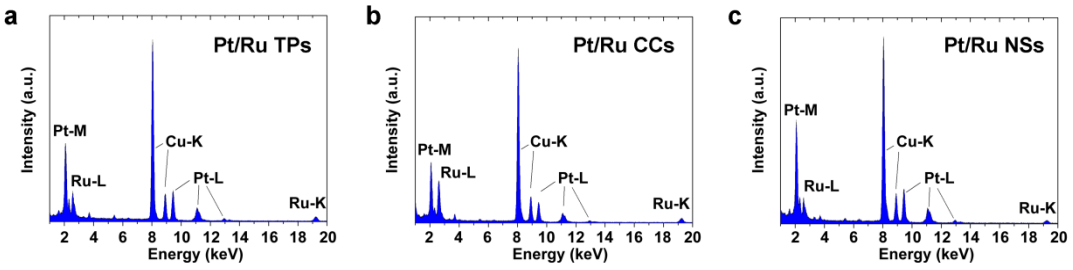

Figure S11. Energy dispersive X-ray spectra of (a) Pt/Ru TPs, (b) Pt/Ru CCs and (c) Pt/Ru NSs after 4 000 cycles of voltage scan in $HClO_4$-MeOH mixed solution.

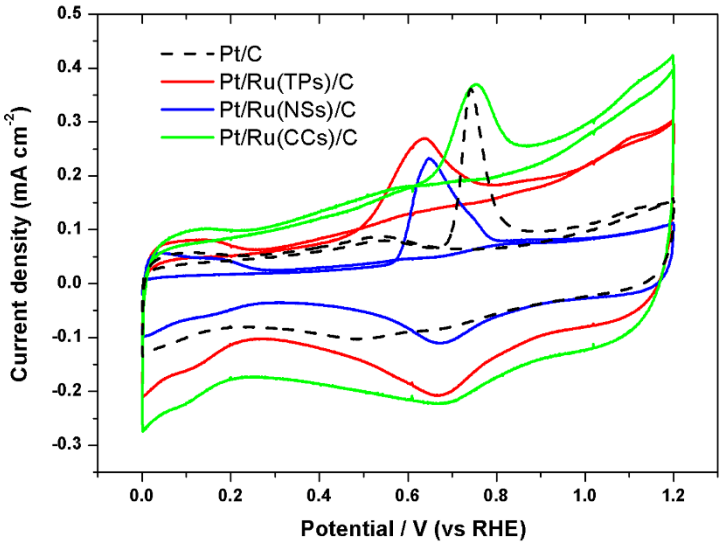

Figure S12. The first cycle and the forward scan of the second cycle of CO stripping tests of Pt/Ru NCs/C and Pt/C in 0.1 M $HClO_4$ at the scanning rate of 50 mV/s after 4 000 cycles of voltage scan.

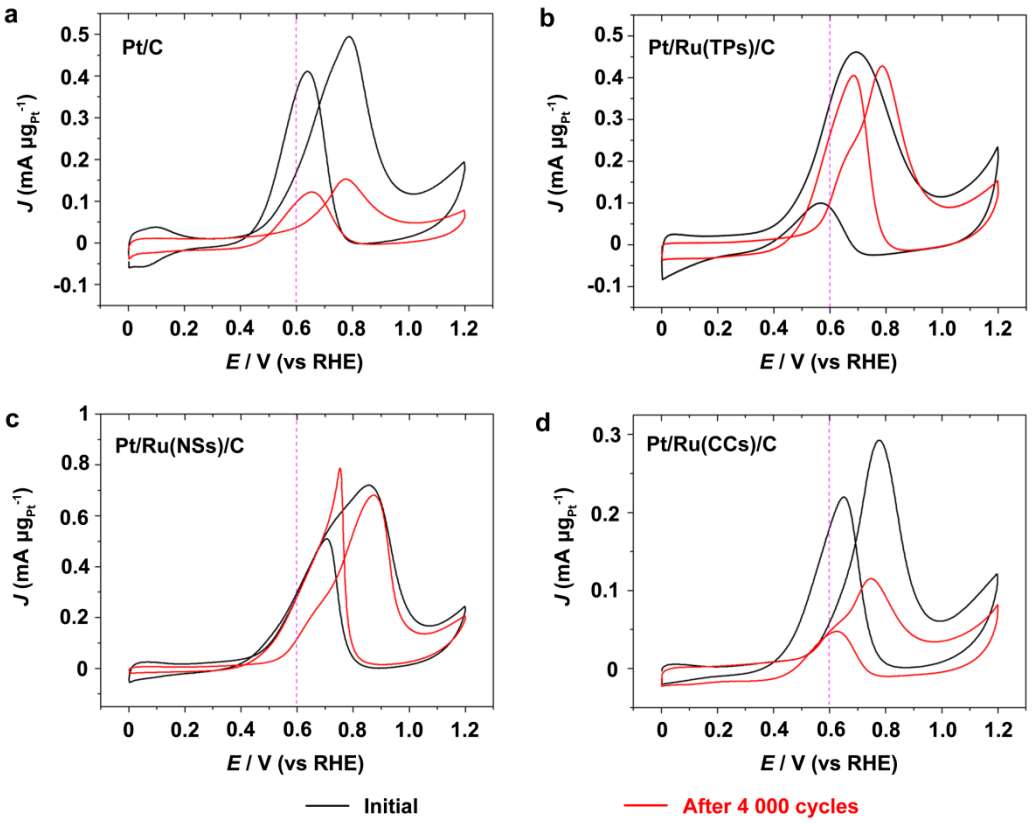

Figure S13. Stable CV curves of as-prepared catalysts and catalysts after 4 000 cycles of voltage scan between 0 and 1.2 V vs RHE of Pt/C (a), Pt/Ru TPs (b), Pt/Ru NSs (c) and Pt/Ru TPs (d) in 0.1 M $HClO_4$ and 0.1 M MeOH at the scanning rate of 50 mV/s. Violet dashed vertical line marks 0.6 V vs RHE.