Supporting Information

# Pt and PtNi nanoparticle-supported multi-walled carbon nanotube electrocatalysts prepared by one-pot pyrolytic synthesis with an ionic liquid

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**Supporting Information Contents:**

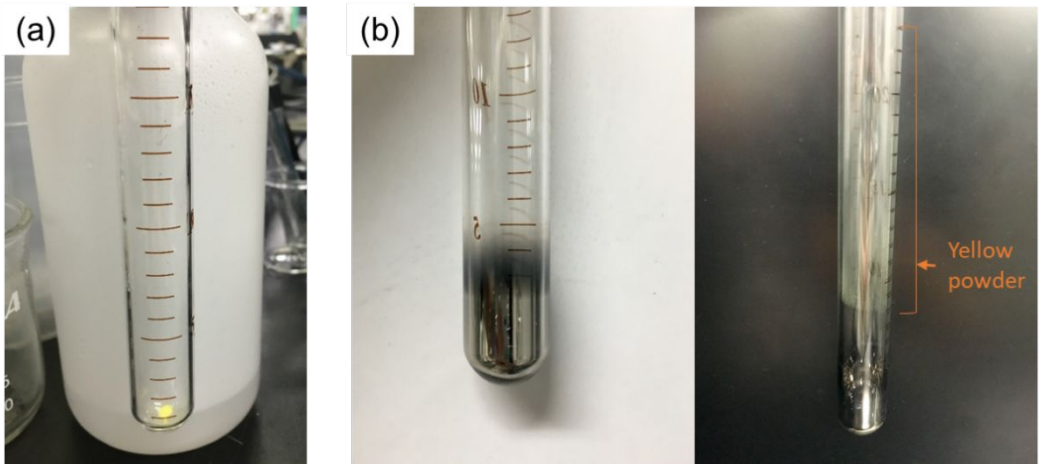


**Figure S1.** Photographs of a test tube containing $Pt(acac)_2$ (a) before and (b) after heating. The test tube was heated at 10 K $min^{-1}$ from room temperature to 473 K.

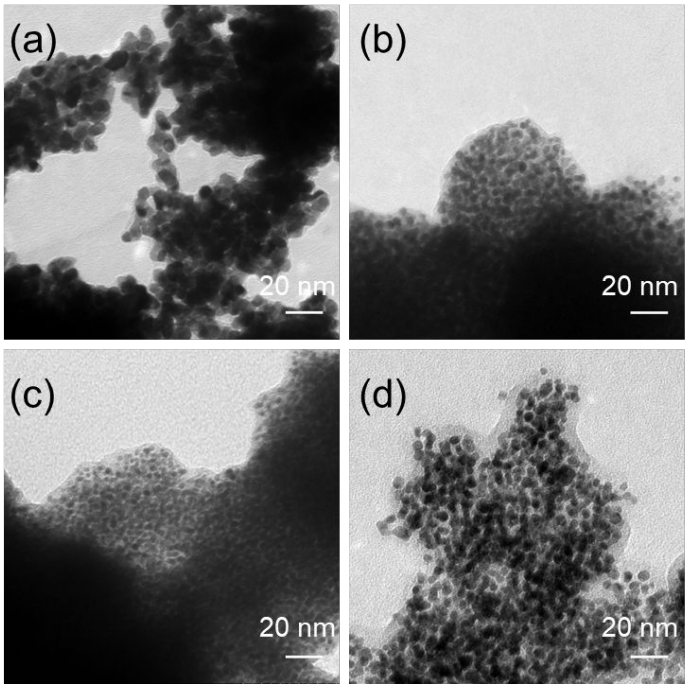


**Figure S2.** TEM images of Pt and PtNi nanoparticles prepared under the same conditions for specimens (a) **1**, (b) **2**, (c) **3** and (d) **4** but not containing MWCNTs.

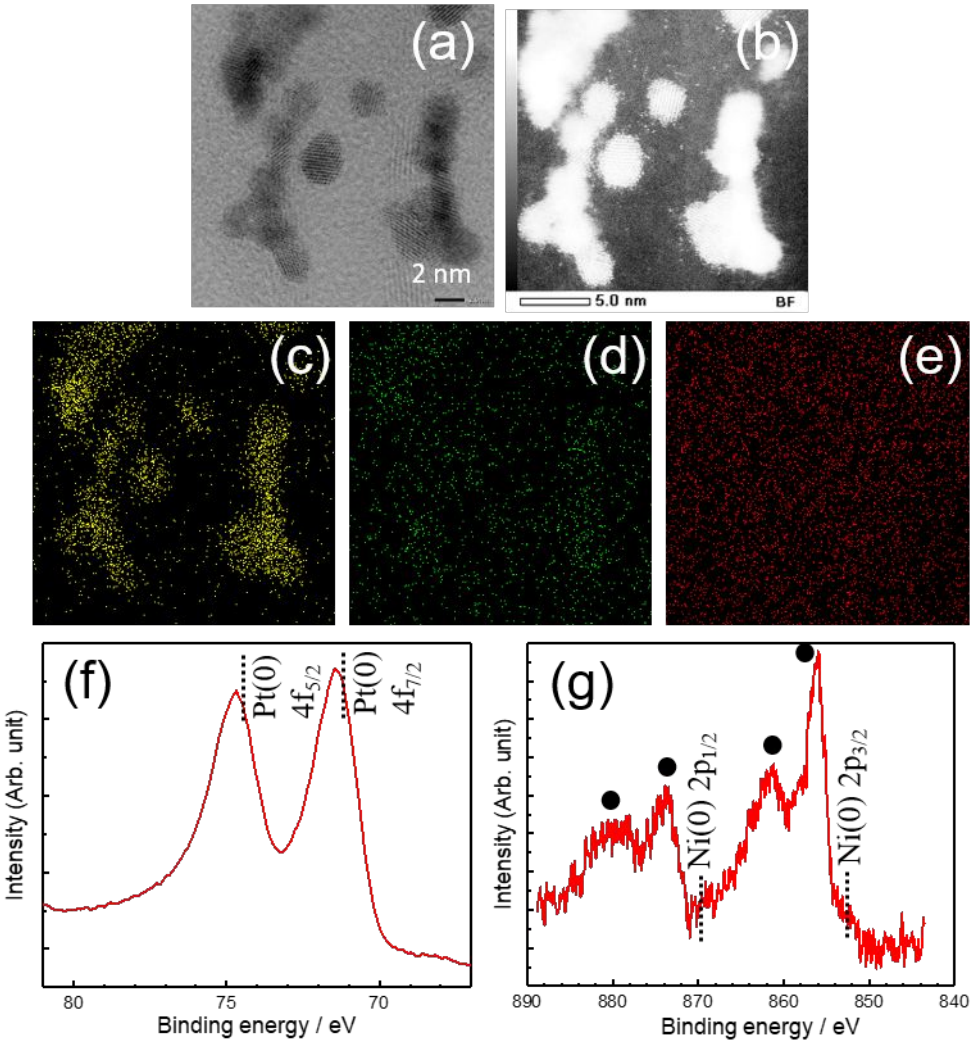


**Figure S3.** (a) High resolution TEM image, (b) HAADF-STEM image, (c-e) EDS mappings, and (f, g) XPS spectra of specimen **3**. The elements are (c, f) Pt, (d, g) Ni, and (e) C. The characterization of XPS spectra was conducted using Ref. S1. The filled circles, ●, shown in (g) are the XPS spectra related to $Ni_2O_3$.

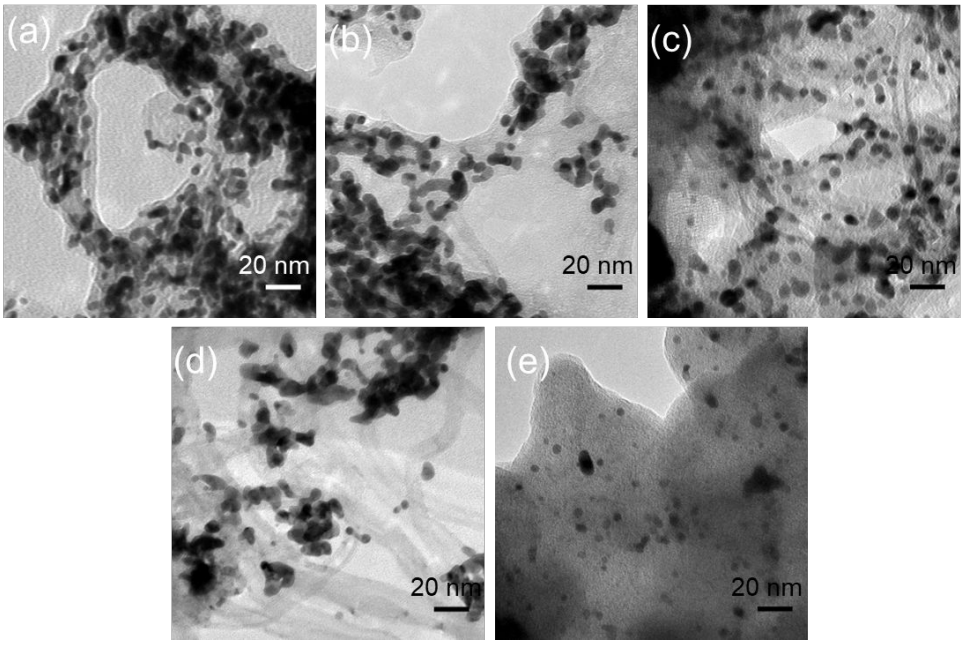


**Figure S4.** TEM images of specimens **1-5** after 15000$^{th}$ potential cycle test. The specimens are (a) **1**, (b) **2**, (c) **3**, (d) **4**, and (e) **5**.

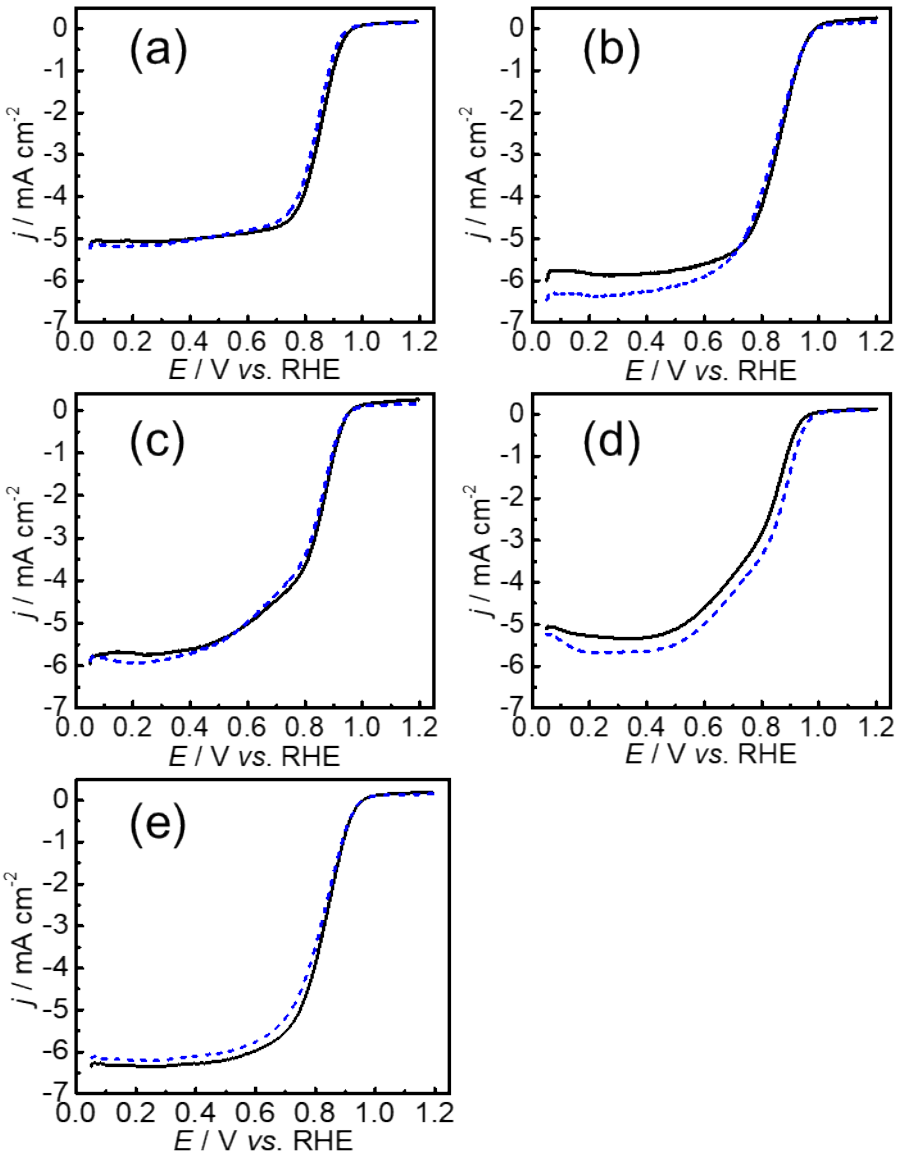


**Figure S5.** RDE-LSVs recorded at glassy carbon electrodes with the specimens in an $O_2$-saturated 0.1 M $HClO_4$ aqueous solution (—) before and (- - -) after the 15000$^{th}$ potential cycle tests. The rotating speeds were 1600 rpm. The scan rates were 10 mV $s^{-1}$. The specimens are (a) **1**, (b) **2**, (c) **3**, (d) **4**, and (e) **5**.

**Table S1.** Summary of Pt and PtNi alloy nanoparticles obtained by different pyrolytic conditions

| Metal precursor concentration / mM | | | Agitation time / h | Mean particle size / nm | Composition of nanoparticle[a] / at% | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Without MWCNTs | | With MWCNTs[c] | |
| $Pt(acac)_2$ | $Ni[Tf_2N]_2$ | $Ni(acac)_2$ | | | Pt | Ni | Pt | Ni |
| 5 | | - | 6 | 6.9 (1.2)[b] | 100 | - | 100 | - |
| 15 | 5 | - | 4 | 4.0 (0.7)[b] | 91 | 9 | 89 | 11 |
| 5 | 5 | - | 4 | 3.0 (0.5)[b] | 73 | 27 | 72 | 28 |
| 5 | - | 5 | 4 | 4.9 (0.9)[b] | 38 | 62 | 42 | 58 |

[a] The composition of the resulting nanoparticles was calculated from EDS measurement.
[b] The values in parentheses are standard deviations.
[c] These values show the composition of the specimens **1**-**4** determined from EDS measurement.

**Reference**

(S1) *Handbook of X-ray photoelectron spectroscopy;* Chastain, J., King, Jr. R. C., Eds.; Physical Electronics, Inc., Minnesota, USA, 1995.