

Supplementary Information

**One-Step Synthesis of Pt/Graphene Composites from Pt Acid Dissolved Ethanol  
via Microwave Plasma Spray Pyrolysis**

Eun Hee Jo<sup>1,2,†</sup>, Hankwon Chang<sup>1,2,†</sup>, Sun Kyung Kim<sup>1</sup>, Ji-Hyuk Choi<sup>1</sup>, Su-Ryeon Park<sup>1,2</sup>, Chong  
Min Lee<sup>1,2</sup>, Hee Dong Jang<sup>1,2,\*</sup>

<sup>1</sup>Rare Metals Research Division, Korea Institute of Geoscience & Mineral Resources, Deajeon,  
34132, Korea

<sup>2</sup>Department of Nanomaterials Science and Engineering, University of Science & Technology,  
Deajeon 34113, Korea

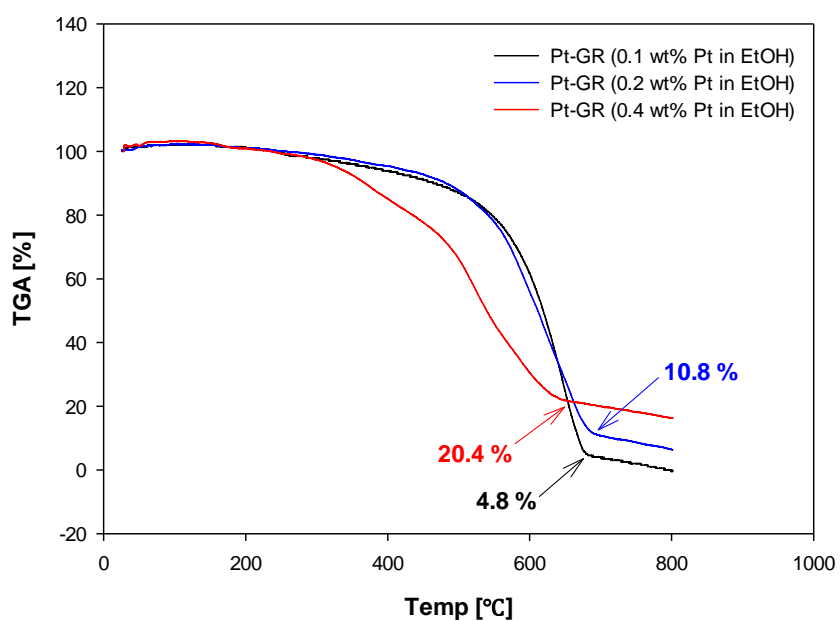


Figure S1 | TGA curves of Pt/GR composite prepared at different concentration of chloroplatinic acid hexahydrate in ethanol.

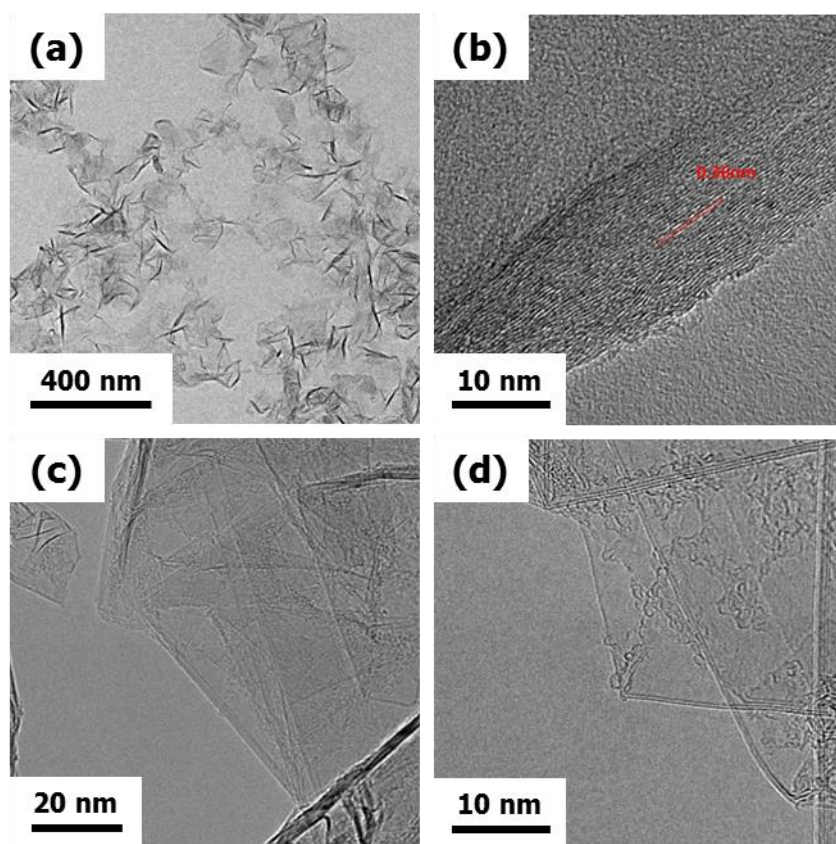


Figure S2 | TEM images of GR sheets prepared by ethanol via microwave plasma spray pyrolysis.

Table S1 | Specific surface area of GR sheets prepared by ethanol via microwave plasma spray pyrolysis.

Sample	Specific surface area (m <sup>2</sup> /g)
GR sheets	1318

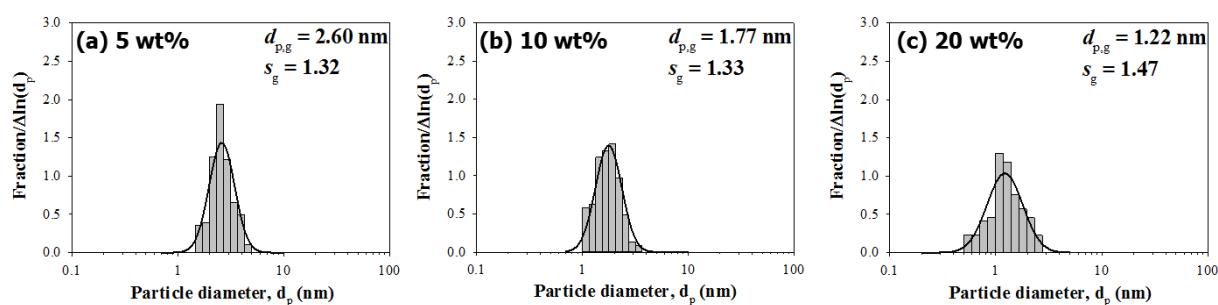


Figure S3 | Size distributions of Pt/GR composite prepared at different Pt contents of (a) 5 wt%, (b) 10 wt%, and (c) 20 wt%.

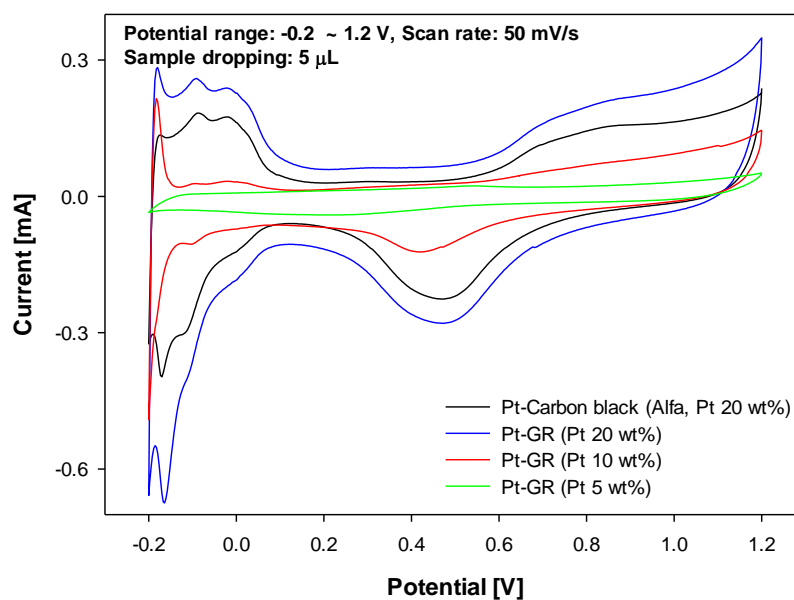


Figure S4 | Cyclic voltammograms of the Pt/Carbon black and Pt/GR composite in a 0.5 M H<sub>2</sub>SO<sub>4</sub> solution.

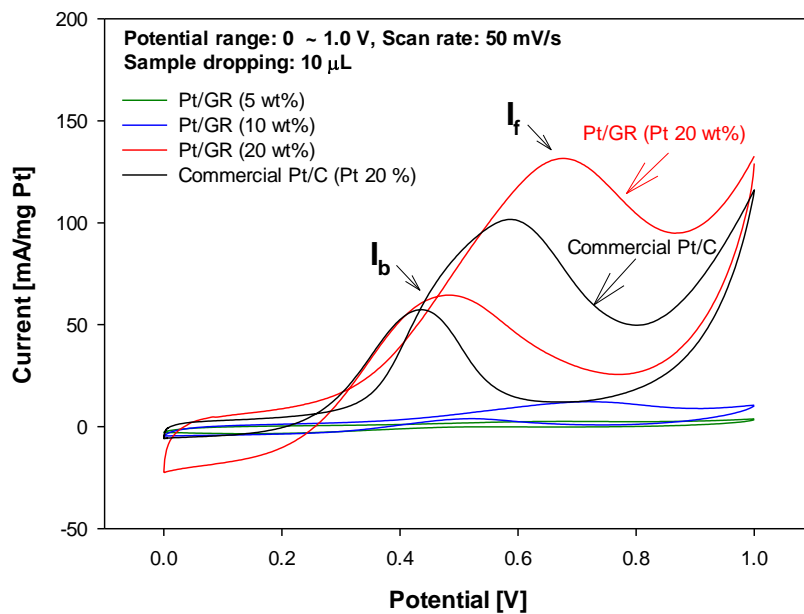


Figure S5 | CVs of Pt mass normalized methanol oxidation reaction on commercial Pt/Carbon black and Pt/GR composite measured in the mixture solution of 0.05 M  $H_2SO_4$  + 1 M  $CH_3OH$  within the potential range of 0 - 1.0 V at a rate of 50 mV/s.

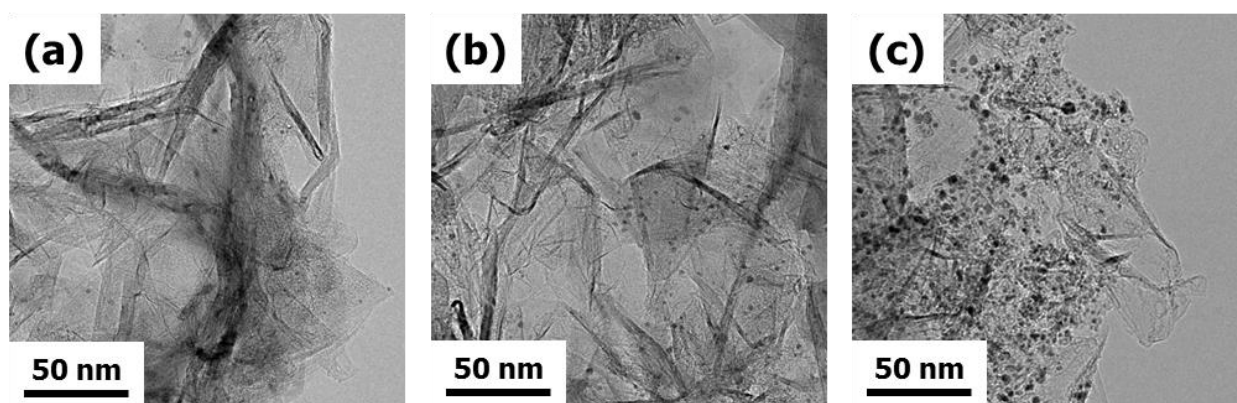


Figure S6 | TEM images of Pt/GR composites prepared at different Pt concentration of (a) 5 wt%, (b) 10 wt%, and (c) 20 wt% after long-term test.

Table S2 | Comparison of catalytic activity of current Pt/GR and other reported Pt based precious catalysts.

Sample	I <sub>f</sub> /I <sub>b</sub> ratio
Pt/C (Kim et al. 2015, Jang et al. 2013, our work)	1.02, 1.30, 1.70
Pt-Ag/C (Kim et al. 2015)	1.29
Pt-Ru/C (Wei et al. 2011)	2.10
Pt-Au (Dutta et al. 2015)	2.15
Pt-Pd (Dutta et al. 2015)	2.45
Pt/GR (our work)	2.20

## References

1. Kim, S. M. et al. Characterization and electrocatalytic activity of Pt-M (M=Cu, Ag, and Pd) bimetallic nanoparticles synthesized by pulsed plasma discharge in water. *J. Nanopart. Res.* **17**, 284 (2015).
2. Jang, H. D. et al. One-step synthesis of Pt-nanoparticles-laden graphene crumples by aerosol spray pyrolysis and evaluation of their electrocatalytic activity. *Aerosol Sci. Technol.* **47**, 93-98 (2013).
3. Wei, Y. C. et al. Promotion of Pt-Ru/C catalysts driven by heat treated induced surface segregation for methanol oxidation reaction. *Journal of Alloys and Compounds* **509**, 535-541 (2011).
4. Dutta, S. et al. Facile Synthesis of Bimetallic Au-Pt, Pd-Pt, and Au-Pd Nanostructures: Enhanced Catalytic Performance of Pd-Pt Analogue towards Fuel Cell Application and Electrochemical Sensing. *Electrochim. Acta* **180**, 1075-1084 (2015).