

SUPPORTING INFORMATION

Support Material Effect for Pt Catalytic Activity *Rikson Siburian*^{1*)}

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Figure 1S confirmed that 20 wt % Pt is supported on GNS, N-G and CB (commercial) by TG/DTA measurements. It indicates that all the Pt atoms in the catalyst precursors are included in the 20 wt % Pt/GNS and Pt/N-G catalysts. As shown in Figure 1S, the amounts of Pt on GNS and N-G are exactly the same as those calculated in the catalyst preparation procedure. The results indicate that all the Pt atoms in the catalyst precursors are included in the 20 wt% Pt/GNS and Pt/N-G catalysts. I can thus control the amount of Pt on GNS and N-G exactly so that one can evaluate the relationship among the particle size, the electronic structure, and the oxygen reduction reaction (ORR) catalytic activity of the Pt on GNS and N-G.

Figure 2S shows XRD patterns at 2θ Bragg angles around 25° and 39° corresponding to C(002) and Pt(111) for the 20 wt% Pt/GNS, Pt/N-G and Pt/CB (commercial) catalysts, respectively. The C(002) peak appears weak and broad for Pt/GNS and Pt/N-G catalysts. The weak and broad peaks at around 25° ($d = 3.5$ Å) means graphene sheets are formed successfully. However, some graphitic (stacked graphene) species should remain due to the weak peak at 25° suggesting a stacking of graphene to some extent. The Pt (111) peak was very weak for all the Pt/GNS and Pt/N-G catalysts. This suggests that the Pt clusters below 1.5 nm is formed. The weak XRD peaks of Pt are characteristic for Pt/GNS catalysts [1], in contrast to the Pt/CB catalysts showing intense XRD peaks of Pt (Figure 2S). The weak and broad peaks of Pt(111) for the Pt/GNS catalysts indicate that very small particles of Pt (< 2 nm) were formed on graphene.

References

1. Siburian R, Nakamura J. Formation Process of Pt Subnano-Clusters on Graphene. J Phys Chem C. 2012;116(43):22947-22953.

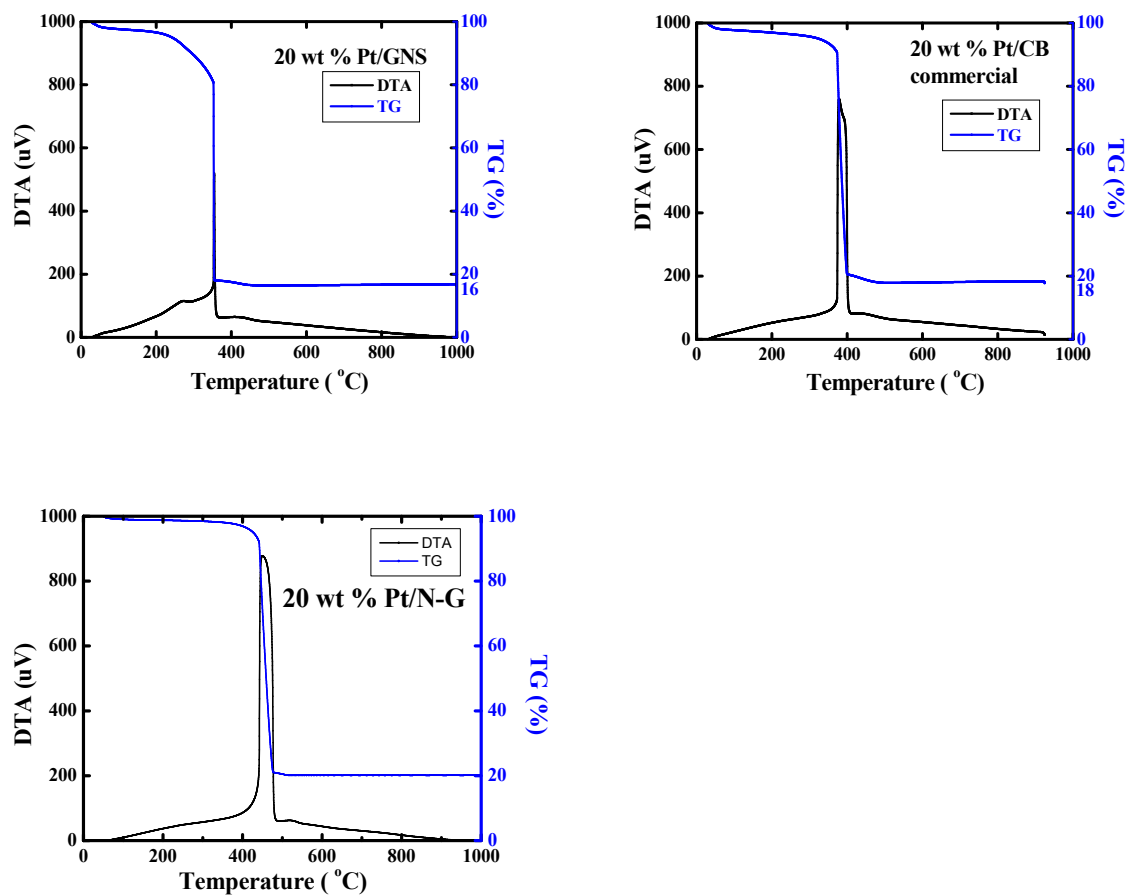


Figure 1S. TG/DTA thermo grams of 20 wt % Pt/GNS, Pt/N-G 150–900 and Pt/CB commercial catalysts

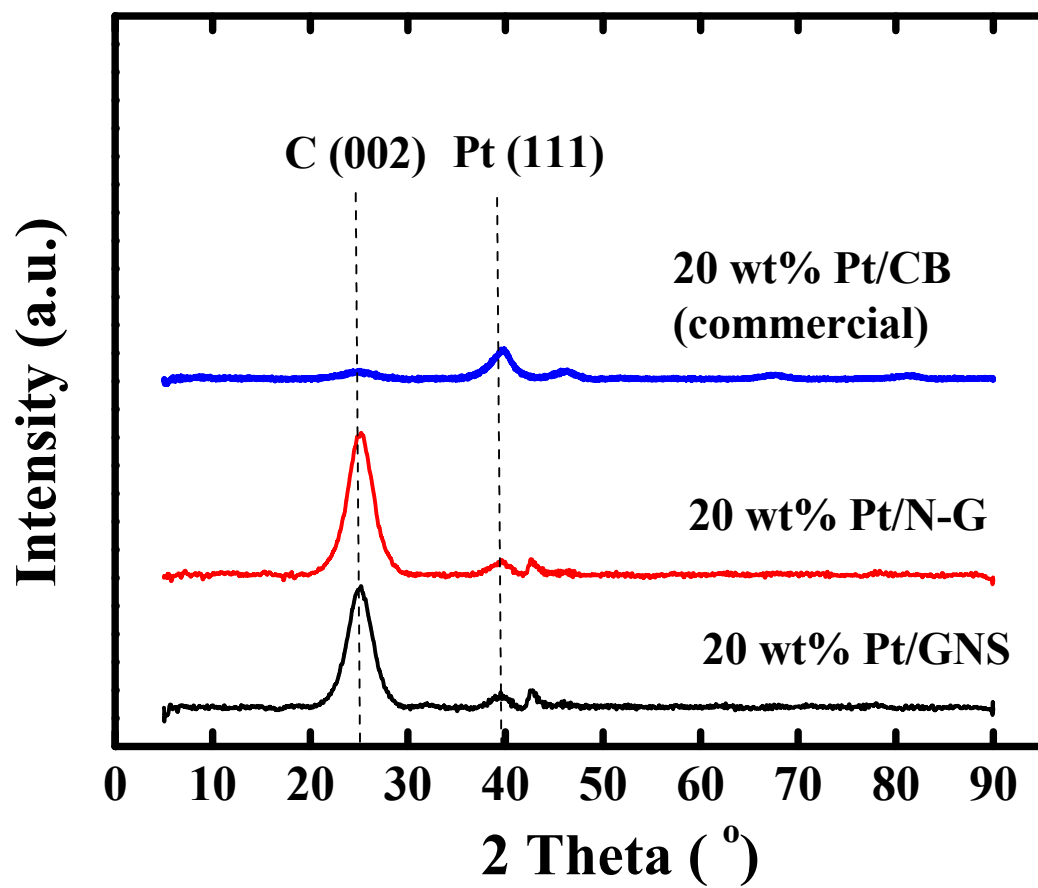


Figure 2S. XRD patterns of 20 wt% Pt/GNS, Pt/N-G and Pt/CB (commercial), respectively.

