GRAPHENE SUPPORTED Pt NANOPARTICLES AS AN ELECTROCATALYST FOR OXYGEN REACTION FOR PEM FUEL CELLS

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Graphene a two-dimensional material constitutes a new nanocarbon comprising layers of carbon atoms arranged in six membered rings [1]. It is distinctly different from carbon nanotubes (CNTs) and fullerenes, and exhibits unique properties which have fascinated the scientific community. Graphene has potential to be used in heterogeneous catalysis. In comparison with CNTs, graphene not only possesses similar stable physical properties but also larger surface areas Additionally, production cost of graphene nano sheets (GNS) in large quantities is much lower than that of CNTs. High cost and the poor durability of electrocatalytic materials is the main problem in commercialization of Polymer electrolyte membrane (PEM) fuel cells. Here, we report a durable electrocatalyst with graphene nanoplatelets (GNPs) as the support, for Pt catalyst toward oxygen reduction reaction (ORR).Graphite oxide (GO) was sensitized with modified Hummers method. GO (100 mg) was loaded in a 250-mL round bottom flask and water (100 mL) was then added, yielding an in homogeneous yellow-brown dispersion [2]. This dispersion was sonicated for 2 hours .Pt nanoparticles were deposited on sonicated GO sheets by a chemical reduction of chloroplatinic acid (H2PtCl6) in hydrazine water solution.X-ray powder diffraction (XRD) was carried to characterizing grapheme nanopalates and Pt particle size. Average numbers of graphene layers calculated using the DebyeScherrer equation.

Cyclic voltametry (CV) is a convenient and efficient tool used to estimate the electro active surface area (ECSA) of Pt catalyst on an electrode. The ECSA of an electrocatalyst not only provides important information regarding the number of electrochemically active sites pergram of the catalyst, but also is a crucial parameter to compare different electrocatalytic supports. Hydrogen adsorp tion/desorption peaks are usually used to evaluate ECSA of the catalyst. The CV curves for different electrocatalysts, namely Pt/CCG in 0.5 M H_2SO_4 solution at a scan rate of $50mV^{-1}$.

In summary, functionalized graphene sheets have been investigated as Pt catalyst supports in oxygen reduction for PEMFCs.Well-dispersed Pt nanoparticles with small particle size were obtained on GNSs.

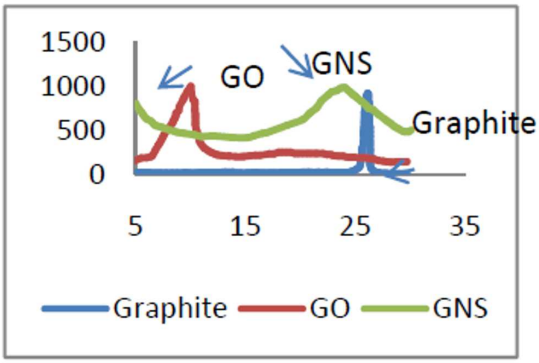

Figure 1: XRD pattern of Graphite, GO, GNS

Samples	Average number of layers	d(A^0)
Raw graohite	90	3.35
GO	17	3.90
Sonicated GO	14	3.92
Reduced GO	16	3.91

Table 1: Average numbers of , raw graphite,graphite oxide, graphene layers

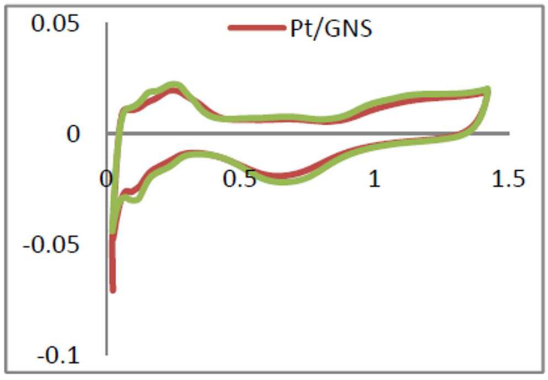

Figure 2: Cyclic voltammograms of Pt/GNS and Pt/C under a scan rate of 50mV^{-1} in 0.5 M H_2SO_4 aqueous solution.

Samples	Average Pt size (nm)	ECSA (m2/g)
Pt/GNS	2.2	75
Pt/C	3.2	64

Table 2: Comparison of different parameters between Pt/CCG and Pt/C hybrids

References

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[2] S. Stankovich, D.A. Dikin, G.H.B. Dommett, K.M. Kohlhaas, E.J. Zimney, E. A. Stach, *et al.*, Graphene-based composite materials, Nature (2006) 442:2826.