Graphitic Carbon Nitride-Graphene Composite as a Fuel Cell Catalyst Support

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Graphitic carbon nitride is a new class of semiconducting polymeric materials with visible light absorption and intrinsic catalytic properties [1-2]. Their high nitrogen content, tunability reminiscent of polymer chemistry, and facile synthesis procedure makes them attractive as alternative fuel cell catalyst supports as they may provide a good balance between activity, durability and cost. Previous work shows that they exhibit excellent durability in a fuel cell environment [3]; however, practical applications are limited by their low surface area and poor conductivity.

In this work, polymeric graphitic carbon nitride was co-synthesized during the reduction of graphene oxide (GO), forming a well-integrated composite structure (gCNH-rGO) containing 30% graphene. The material was decorated with platinum nanoparticles, and then investigated for its electrochemical properties and applications as a catalyst support for polymer electrolyte membrane (PEM) fuel cells.

Initial results show that the electrochemical surface area of Pt supported on gCNH/rGO was three times higher than Pt on gCNH alone, indicating that the incorporation of rGO improves the electronic conductivity of the support. The performance of Pt/gCNH-rGO as PEM fuel cell anode was comparable to commercial Pt/C, as shown in the fuel cell polarization curve in Figure 1. In addition, long-term potential cycling test shows that Pt/gCNH-rGO is more stable than commercial Pt/C, making it an attractive alternative, durable catalyst support for PEM fuel cell anodes.

References

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Figures

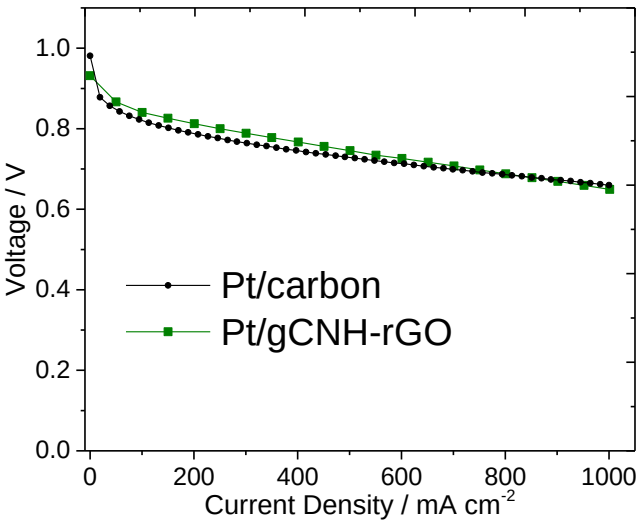

Figure 1: Fuel cell polarization curves of Pt/gCNH-rGO and commercial Pt/carbon and as anode in H_2/O_2 cell at 80°C