Fe-Pt-N supported Reduced Graphene Oxide Electrocatalysts for oxygen reduction reaction in polymer electrolyte fuel cells

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Abstract

The sluggishness of the oxygen reduction reaction (ORR) and consequent requirement of expensive Pt as electrocatalyst is one of the major factors determining the polymer electrolyte fuel cell performance. The scarcity of Pt means, either a significant reduction in Pt use or altogether its removal from the electrode becomes mandatory before commercialization of the technology. Research in this direction involves many strategies; 1. Decreasing the Pt particle size, 2. Alloying with cheaper metals, 3. Core-shell structures with Pt as shell to reduce Pt usage and 4. Non-precious metal catalysts based on Metal-phorphirin based systems. Non-precious metal catalysts utilizing nitrogen doped carbon nanostructures have gained significant interest in the last 5 years although a combination of this with Pt incorporation has not been studied. We prepared Fe-Pt-N on reduced graphene oxide (Fe-Pt-N/RGO) by mixing graphene oxide (GO) with 1,10-phenonthroline and iron acetate in ethanol and reduced them using sodium borohydride. Thus prepared Fe-N/C were used mixed with K_2PtCl_6 and reduced further by $NaBH_4$. The electrocatalysts were characterized by XRD, XPS, TGA, CV, LSV and impedance measurements. Prepared catalysts showed good catalytic activity towards ORR while XRD results showed particle sizes in nm range. Durability measurements by potential cycling are also carried out on the catalysts under simulated conditions.

References

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Figures

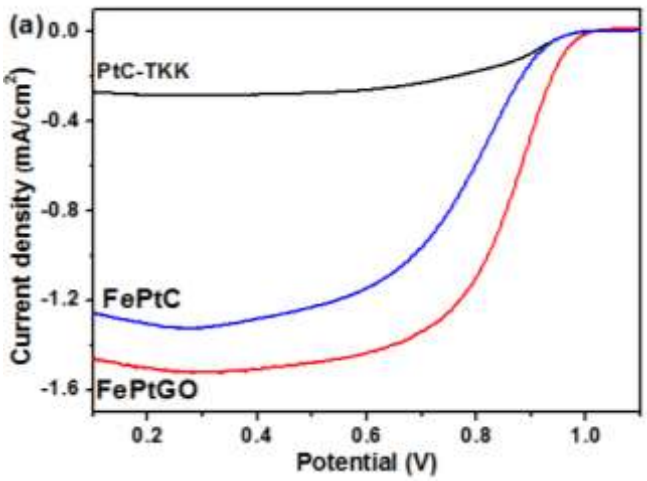

Figure1: Linear sweep voltammetry obtained at a rotation rate of 2000 rpm in 0.1 M HClO4 with reversible hydrogen electrode as reference and Pt mesh as counter electrode.