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Low-cost clay-polymer nanocomposites as oxygen reduction catalysts for fuel cell applications

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Fuel cells are a kind of galvanic cells with some special features. In fuel cells, reactants are always supplied externally and the anodic half reaction is mandatorily the oxidation half-reaction of a fuel such as hydrogen, methane or any oxidizable fuel, while the cathodic half-reaction is always the reduction half-reaction of oxygen gas. Both reactions are kinetically very slow and hence suitable catalysts are mandatory to drive these reactions with appreciable rates. Reduction of oxygen is catalyzed by Pt and Rh is also used to prevent the poisoning of Pt by byproducts. This Pt-Rh catalyst is prohibitively expensive and hence alternative low-cost catalysts are required to use fuel cells in power production where fuel cells produce energy in environmentally friendly manner. Numerous researchers have worked on various lines to bring down the cost of oxygen reduction catalysts, which include the use of Pt nanoparticles, or increasing surface area by depositing nano-particulate islands on large surface area supports, alloying platinum with less expensive base metals, developing novel supports or utilizing low-cost materials other than noble metals. In this regards, we have already shown that Ce (III)-polypyrrole (PPY) -montmorillonite (MMT) nanocomposite to be such a very low-cost oxygen reduction catalyst. We now present several other systems which have similar efficiencies for oxygen reduction. These include Fe (II)/PPY/MMT, Ag/PANI (poly-aniline)/MMT, Ag/PANI/MMT, Pd/PPY, PPY/Porphyrins and so on. These materials have been thoroughly characterized by XRD, FT-IR, AC impedance spectroscopy, cyclic voltammetry, etc., and oxygen reduction efficiencies are compared and the results are discussed in this presentation.

Biography

R M G Rajapakse holds a BSc special degree in Chemistry from University of Peradeniya and PhD and DIC from Imperial College, London. He is a Senior Professor in Chemistry and is also the Coordinator of the MSc Program in Nano-science and Nanotechnology. He has worked in leading research groups in UK, USA, Germany and Japan and is currently supervising 12 PhD students. He has a large number of publications and 6 patents. He has received 13 awards for excellence in research and is a regular Visiting Professor to Shizuoka University, Japan.

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