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## Catalytic intervention of transition metals in Pd based nanocatalyst for direct ethanol fuel cell

**Jayati Datta, Abhishek De and Achintya Mondal**
Indian Institute of Engineering Science and Technology, India

The Proton Exchange Membrane (PEM) fuel cell has currently occupied a commanding position among the renewable technologies for clean and safety power generation. A special focus has been made on the state of the art technologies for cost reduction by developing CO- tolerant plurimetallic non-platinum catalyst formulation for designing and fabrication of ethanol based Fuel Cell. The synthesized catalyst materials include low level Pt and Pt free ternary combinations of Co and Ni with Pd, supported on vulcan XC-72 for use as anode component in a Direct Ethanol Fuel Cell (DEFC) operating with an Anion-Exchange Membrane (AEM) at room temperature. Information on physicochemical properties, structural characteristics, surface morphology and composition of the catalyst matrices was obtained employing respective techniques like XRD, EDAX, XPS and TEM etc. A series of electrochemical techniques including cyclic voltammetry, chronoamperometry, impedance spectroscopy and potentiostatic polarization were employed to investigate the catalytic efficiency of the materials toward Ethanol Oxidation Reaction (EOR) in alkaline medium. The enhanced electro-catalytic activity of the ternary electrode is ascribed to the catalytic intervention of the transition metal ad-atoms, Ni and Co and their surface oxides culminating to higher electrochemical surface area, preferred-OH adsorption on the surface and excellent CO tolerance of the Nano-catalysts. Considerable yield of the intermediate oxidation products $CH_3CO_2-$ and $CO_3^{2-}$ is obtained with the Pd, Co, Ni/C catalyst compared to Pt/C and Pd/C, as estimated by ion chromatography. Further, the electrical performance of the in-house fabricated DEFC with the non-Pt ternary matrix was outstandingly high, exhibiting power density output of 35 $mW/cm^2$. All these output parameters collectively substantiate to the catalytic superiority of the Pd, Co, Ni/C catalysts, at the same time, establish the affordability of using such Pt alternatives in low temperature DEFC.

jayati_datta@rediffmail.com