NOVEL Pt-BASED ELECTROCATALYSTS FOR THE OXYGEN REDUCTION REACTION IN PROTON EXCHANGE MEMBRANE FUEL CELLS (PEMFCs)

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ABSTRACT

The growing demand for renewable energy sources gives plenty of space to the field of electrochemistry/electrocatalysis. Proton Exchange Membrane Fuel Cells (PEMFCs) are at the forefront of decarbonizing the global economy. They are among the most promising electrochemical devices because of their low operating temperature and high-power density. Their application in the conversion of chemical energy stored in hydrogen and oxygen to electric energy makes them promising devices for the energy supply in automotive applications [1].

State of the art catalysts for the anode (Hydrogen Oxidation Reaction, HOR) as well as the cathode (Oxygen Reduction Reaction, ORR) are typically based on platinum-supported on carbon. For HOR a minimum amount of Pt is sufficient as this reaction is fast, in contrary the ORR is a sluggish reaction and demands higher loadings [2]. Thus, to sustain the high rate of fuel cell commercialization, cost reduction and durability improvement are the two most significant challenges that must be held. One direction to market value viable PEMFCs is the engineering and reduction of noble-metal content for oxygen reduction reaction (ORR).

In this work, Pt supported on functionalized carbon nanotubes [3-5] are for the first time investigated as cathode catalyst in a low temperature PEMFC using Nafion as the electrolyte. The electrochemical performance in terms of activity and durability will be presented according to the DOE protocols. In addition, the structural characterization of the catalysts will be shown and its correlation to the electrochemical performance will be discussed. Finally, the effect of the hydration level of the cathode feed gas on the electrochemical interface is investigated.

KEYWORDS: Electrocatalysts, Oxygen Reduction Reaction, PEMFCs, Activity, Fuel cell performance

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