Effects of PAMAM Dendrimers on the Catalytic Layers of an MEA in a PEM Fuel Cell

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The conductivity of fuel gas, electrons and protons at the three phase interfaces in the catalytic layers of proton exchange membrane fuel cells must be optimized to provide efficient transport to and from the electrochemical reactions in the solid polymer electrolyte. The aim of reducing transport loss in the catalytic layer by increasing the volume of the conducting medium can be achieved by filling the voids in the layer with small electrolytes, such as dendrimers. Generation 1.5 and 3.5 polyamidoamine (PAMAM) dendrimer electrolytes are well controlled nanometer-sized materials with many peripheral ionic exchange -COOH groups and were used for this purpose in this study. The electrochemically active surface area of the deposited catalyst material was also investigated using cyclic voltammetry. The performances of fuel cells with added PAMAM dendrimers were found to be comparable to that of a fuel cell using a conventional membrane electrode assemblies (MEA), although the utilization of Pt was reduced by the addition of the dendrimers to the catalytic layer. This result for the fuel cell performance is probably due to the improvement in kinetic transport that arises from the increases in the contact areas of the three phases.