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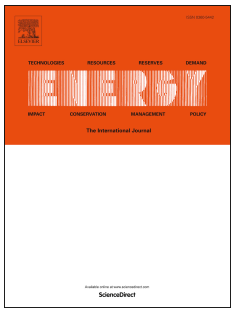

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Gas Diffusion Layer Development using Design of Experiments for the Optimization of a Proton Exchange Membrane Fuel Cell Performance

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Abstract

Gas Diffusion Layer (GDL) was optimized to maximize the performance of a Proton Exchange Membrane Fuel Cell (PEMFC) using design of experiments. The fabrication of the GDLs consisted of using a non-woven carbon paper substrate, coated with a mixture (slurry) of Pureblack Carbon (PB), Vapor Grown Carbon Fiber (VGCF) and the polytetrafluoroethylene (PTFE), all dispersed in water containing Sodium Dodecyl Sulfate (SDS). The concentration of PB and the PTFE in the slurry was organized through the application of a 2^2 full factorial design of experiments, with the quantity of PB and the quantity of PTFE as the factors. For each GDLs a Membrane-Electrodes Assemblies (MEA) were fabricated using Catalyst Coated Membrane (Nafion) CCM, in single cell PEMFC, then the polarization curve was evaluated using H_2/Air as well as H_2/O_2 at various relative humidity (RH) conditions. In addition, each GDLs were characterized by pore size distribution and contact angle using SEM, Goniometer and Hg Porosimeter. It was found that the optimized GDLs exhibited a power density of 487 mW/cm^2 (H_2/Air, 70 °C, 70 % RH,) and 995 mW/cm^2 (H_2/O_2,70 °C, 100 % RH) for the optimum composition of 73 % PB

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