

Performance Evaluation of a Fuel Cell Membrane Electrode Assembly Prepared from a Reinforced Proton Exchange Membrane

Authors : Yingjeng James Li, Yun Jyun Ou, Chih Chi Hsu, Chiao-Chih Hu

Abstract : A fuel cell is a device that produces electric power by reacting fuel and oxidant electrochemically. There is no pollution produced from a fuel cell if hydrogen is employed as the fuel. Therefore, a fuel cell is considered as a zero emission device and is a source of green power. A membrane electrode assembly (MEA) is the key component of a fuel cell. It is, therefore, beneficial to develop MEAs with high performance. In this study, an MEA for proton exchange membrane fuel cell (PEMFC) was prepared from a 15-micron thick reinforced PEM. The active area of such MEA is 25 cm². Carbon supported platinum (Pt/C) was employed as the catalyst for both anode and cathode. The platinum loading is 0.6 mg/cm² based on the sum of anode and cathode. Commercially available carbon papers coated with a micro porous layer (MPL) serve as gas diffusion layers (GDLs). The original thickness of the GDL is 250 μ m. It was compressed down to 163 μ m when assembled into the single cell test fixture. Polarization curves were taken by using eight different test conditions. At our standard test condition (cell: 70 °C; anode: pure hydrogen, 100%RH, 1.2 stoic, ambient pressure; cathode: air, 100%RH, 3.0 stoic, ambient pressure), the cell current density is 1250 mA/cm² at 0.6 V, and 2400 mA/cm² at 0.4 V. At self-humidified condition and cell temperature of 55 °C, the cell current density is 1050 mA/cm² at 0.6 V, and 2250 mA/cm² at 0.4 V. Hydrogen crossover rate of the MEA is 0.0108 mL/min*cm² according to linear sweep voltammetry experiments. According to the MEA's Pt loading and the cyclic voltammetry experiments, the Pt electrochemical surface area is 60 m²/g. The ohmic part of the impedance spectroscopy results shows that the membrane resistance is about 60 m Ω *cm² when the MEA is operated at 0.6 V.

Keywords : fuel cell, membrane electrode assembly, proton exchange membrane, reinforced

Conference Title : ICPSE 2016 : International Conference on Power Systems Engineering

Conference Location : Kuala Lumpur, Malaysia

Conference Dates : August 18-19, 2016