Gas Difusion Electrodes for PBI Cells

Li, Qingfeng; Pan, Chao; Jensen, Jens Oluf; Nilsson, Morten Sixten; Bjerrum, Niels

Published in:
Meeting Abstracts - Electrochemical Society

Publication date:
2006

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Gas Diffusion Electrodes for PBI Cells 
Q. Li, C. Pan, J. O. Jensen, M. Nilsson and N. J. Bjerrum

Department of Chemistry
Technical University of Denmark
Building 207, DK-2800 Lyngby, Denmark

Acid doped polybenzimidazole (PBI) membranes have been suggested as electrolyte for proton exchange membrane fuel cells (PEMFC) and received great attention, as recently reviewed. Fuel cell tests have been performed with different types of fuels such as hydrogen, hydrogen containing CO, methanol and others. Methods for preparing gas diffusion electrodes and membrane-electrode assemblies (MEAs) with PBI membranes have been developed by several groups. The gas diffusion electrodes were constructed with PBI as the catalyst binder or, when PTFE was used as the catalyst binder, the electrodes were impregnated with PBI. The loading of the polymer in the catalyst layer is a key parameter. The PBI containing electrodes are then doped with phosphoric acid in order to improve the proton conductivity.

In this work a tapecasting method is used for preparing gas diffusion electrodes for PBI cells. The total porosity of electrodes was changed from 43% to 64% with help of porogens as additives to the catalyst slurry for electrode casting. The porosity of gas diffusion electrodes is determined by absorbing toluene into the electrodes under vacuum and measuring the weight change of the electrode samples. Fig. 1 shows the porosity variation of the gas diffusion electrodes made from slurries containing various porogens. Of the selected porogens, ammonium oxalate seems to be an effective one. It decomposes completely during the drying of electrodes at 250°C and gives an improved overall porosity from 43% to above 60%. ZnO is also effective, however, it should be removed afterwards by washing electrodes with dilute sulfuric acid.

The performance of fuel cells with electrodes of varied porosities was investigated at temperatures up to 200°C. The used fuel gases are pure hydrogen and hydrogen containing 25% CO₂ and the oxidant is either oxygen or air. The operational pressure was changed from ambient to 4 bars on both anode and cathode sides.

Acknowledgement. This work has received financial support from the European Commission (Project no. SES6-CT-2004-502782).

References