Preparation of gas diffusion electrodes for high temperature PEM-type fuel cells

Petr Mazur\(^a\), Jakub Malis\(^a\), Martin Paidar\(^a\), Jan Schauer\(^b\), Karel Bouzek\(^a\)

\(^a\)Department of Inorganic Technology, Institute of Chemical Technology Prague, Technicka 5, 166 28 Prague 6, Czech Republic
Tel. +420 724556440; email: mazurp@vscht.cz

\(^b\)Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, v.v.i., Heyrovsky sq. 2, 162 06 Prague 6, Czech Republic

Received 3 August 2009; Accepted 22 December 2009

**ABSTRACT**

Gas diffusion electrodes (GDEs) were prepared and optimized for testing a novel electrolyte for PEM-type fuel cells operating at elevated temperatures based on polymer-supported ionic liquid (IL). For the construction of the GDE, a commercial E-TEK gas diffusion layer was employed. On its surface, a catalyst layer (CL) was deposited by the brushing technique. The catalyst ink contained a commercial, carbon-supported platinum catalyst (30 wt.% – E-TEK), polymer binder and solvents. As a binder, polytetrafluoroethylene (PTFE) or polybenzimidazole (PBI) was applied. Various amounts of binder were used in the CL. The utilization of PBI was found to be more advantageous than PTFE. 15 wt.% PBI was identified as the optimum amount in the CL. Such electrodes exhibit a relatively good performance in a laboratory-scale single fuel cell employing commercial PBI–based membranes doped by H\(_3\)PO\(_4\) (50 mW/cm\(^2\) at 0.4 V and 140°C). Although polymer-supported IL-based membranes exhibit relatively high ionic conductivity, the performance of a fuel cell utilizing these membranes produced power output approximately 30 times lower compared to PBI-based membranes.

**Keywords:** Gas diffusion electrode; Polymer electrolyte; Ionic liquid; PBI; Fuel cell