

Membrane electrode assembly with high efficiency and stability: effect of solvent type and membrane composition

ABSTRACT

Membrane electrode assembly (MEA) method is being widely considered in proton exchange membrane fuel cell (PEMFC) preparation. This work describes for the first time how PEMFC performance can be enhanced, while using relatively low temperature processing for the MEA, by choosing the suitable solvent and suitable ionomer (nafion) content. Three dispersion solvents (water, ethylene glycol and ethanol) have been examined here, and ethanol (with lowest boiling point) showed best PEMFC performance. In addition to its non-hazardous nature, the low boiling point ethanol allowed manufacturing the working membrane at 130°C or lower besides using a safe solvent to use. In each solvent system, different nafion concentrations were used (10%, 20% and 30%). The 30% nafion concentration in ethanol showed highest performance (Open circuit potential of 0.88 V and output working potential of 0.67 V at 20 mA/cm² current density) among the series. The anode and cathode, of the MEA, were both fabricated using same catalyst material (Platinum) and same nafion sheet thickness (50 μm). The spray method was employed. The electrochemical performance for the prepared MEA fuel cells was assessed by linear sweep voltammetry to evaluate the open circuit voltage.

Keyword: Dispersion solvent; Hydrogen fuel cell; MEA; Nafion ionomer