Physiochemical Characteristics of Solid Electrolyte Membranes for High-Temperature PEM Fuel Cell

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Proton exchange membrane fuel cell (PEMFC) is one of the most promising clean energy conversion devices, whereas polybenzimidazole (PBI) polymer consider the potential electrolyte membrane for high temperature. In this study, solid polymer electrolyte membranes were studied the physiochemical occurrences such as proton conductivity, ion transfer number, oxidative stability, tensile strength, TGA, and FTIR analysis. The PBI copolymer-1 was shown the maximum proton conductivity (6.52 mS/cm) and ion transfer number (0.9723) compared with the PBI copolymer-2 and Nafion specimens. Based on AFM results, the PBI copolymer-1 had low surface roughness and remarkable grain number which favorable for ion conductivity. Despite that, it had excellent chemical stability in terms of Fenton solution and maximum weight loss measured at 4.5% after treated 200 h. The PBI copolymer-1 had high thermal and mechanical strengths that demonstrated in tensile test and TGA analysis. Moreover, acid doped solid electrolyte membranes were successfully demonstrated in single cell, which exhibited at 99.75 mW/cm² power density that can be recommended as a proton exchange membrane for high-temperature PEMFC application.

Keywords: Polybenzimidazole, Acid doping, Nyquist plot, Ion transfer number, Fenton test

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