Nafion-1,2,3-Triazole Composite Membrane for Fuel Cell

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Polymer electrolyte membrane fuel cells (PEFCs) are expecting to apply as a power generating device because they are clean energy systems, have high energy densities, and have high conversion efficiency. However, for the commercial application, there are still required many improvements at the fuel cell components. One of them is membrane electrolytes. Recently topic is of the development of high temperature/low humidity tolerant electrolytes. Operating at temperature greater than 100^{o}C leads to the advantages of improved tolerance of the Pt electrodes to carbon monoxide; reduced electrolyte resistance within the electrodes and electrolytes; and it simplifies system-wide heat management whilst improving the effectiveness of co-generation of water, heat and electricity. For the application of high temperature ($\leq$130^{o}C) PEFCs, electrolyte membrane has to show high proton-conductivity under low humidity or nonhumudity condition. To do that, one is to have high IEC and the other is to use a base material to replace water. For the later method, we studied using various base materials such as benzimidazole ($C_7H_6N_2$), 1,2,4-triazole ($C_2H_3N_3$), 2-methylimidazole ($C_4H_6N_2$), 1-methylimidazole ($C_4H_6N_2$), imidazole ($C_3H_4N_2$) and 2-undecylimidazole ($C_{14}H_{26}N_2$) monomers [1].

Recently, we obtained Nafion-1,2,3-triazole composite membrane using autoclave solution processing [2,4]. The composite membrane was very stable under water and acid condition. This can be due to the reaction between Nafion and alchoal-1,2,3-triazole during the autoclave treatment. The IEC of the membrane was lower than that of Nafion, but the cell performance was higher than that of Nafion 112 above 100^{o}C, low humidity. It may be due to the role of 1,2,3-triazole in the membrane. We are going to discuss in detail the properties of the membrane.

Acknowledgements
This work was partially supported by MEXT program for development of environmental technology using nanotechnology.

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