Sulfonation of PVA with HSO_3Cl: Investigation by FTIR Spectroscopy

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Among the various fuel cell systems known today, the proton-exchange membrane fuel cell and direct methanol fuel cell systems have proven to be an attractive and more promising option than alkaline, solid oxide, or molten carbonate fuel cell system for power generation in protable, stationary, and mobile applications. For direct methanol fuel cell systems, it shows a considerably lower performance than the of hydrogen/air fuel cell because of the inefficient methanol oxidation and the methanol crossover from anode to cathode through the membrane. Methanol crossover not only wastes fuel but also causes performance losses at the cathode due to the consumption of oxygen and catalyst poisoning. In this study, we have performed the experiment in order to improve the properties of the membrane by sulfonating of PVA with HSO_3Cl and it has been monitored by FTIR spectroscopy. Because the pendant sulfonic acid ($-SO_3H$) group imparts strong acidic characteristics for facile proton transport. The FTIR spectra of the PVA film at different sulfonated states is demonstrated in Figure 1. The fingerprints of the sulfonic groups are observed at 1056, 1135 and 1204 cm^{-1} and the C-OH group is observed at 1091 cm^{-1}. As can be seen that the magnitude of the wavenumber at 1204 cm^{-1} is decreased and the peak position of the wavenumber at 1091 cm^{-1} is shifted to higher wavenumber position, indicating an increase of the degree of sulfonation. It may affect the proton transport ability of the membrane. The phenomena will be futher confirmed by electrochemical measurmants.

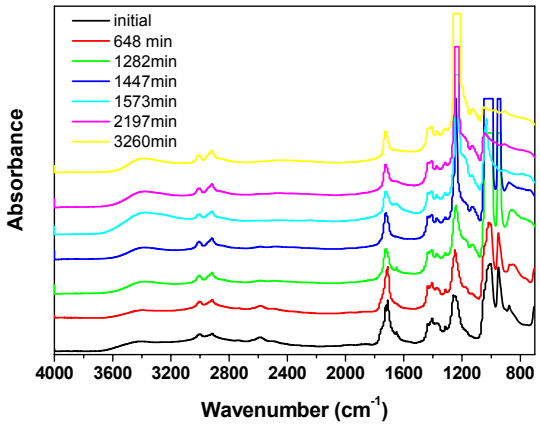

Figure 1. The FTIR spectroscopy of poly (vinyl alcohol) film at different sulfonated states.