

CHAPTER VI

CONCLUSIONS

Based on proton transfer mechanism related to hydrogen bond network and molecular movement, our study are concerning in (i) a series of urocanic acid with various chain lengths (**CxU**) as proton conductive species (ii) polymer blends (**SPEEK-CxU**) for improving proton conductivity performance under high temperature. Moreover, we extend our work to (iii) thermochromic property of SPEEK thin film as a unique property. In the case of **CxU**, methylene units introducing in urocanic acid structure can provide a various kind of packing structure related to low melting temperature. With this property, a series of **CxU** can induce proton conductivity as high as 10^{-4} S cm⁻¹ at melting temperature. **C4U** shows the lowest melting temperature (46 °C) which induces proton conductivity performance very effective as compared to other derivatives. Moreover, **C4U** performs the lowest E_a referring to ease of proton transfer in system. Therefore, it is a guideline that low melting temperature compounds act as good proton conductive species with a balance of hydrogen bond and molecular movement. Moreover, a series of **CxU** were blended in SPEEK matrix to improve the operation under high temperature. Proton conductivity is in a certain level as high as 10^{-4} S cm⁻¹ above 90 °C as compared to dried SPEEK (10^{-8} S cm⁻¹ above 90 °C). As well known about alkyl urocanates, at high temperature, these derivatives can perform similar behaviour to water clusters. This is a main factor for enhancing proton conductivity of SPEEK blended systems under high temperature. Therefore, a series of **CxU** perform synergistic effect of imidazole ring and water molecules for improving proton conductivity via SPEEK blended membranes. It is important to note that SPEEK exhibits reversible thermochromic properties because of interactions based on sulfonic acid group and aromatic rings on polymer backbone. This phenomenon was revealed by basic characterization including UV-vis, and FTIR under variation of temperature. The present works give a guideline information about synchronized effect of hydrogen bond network and the chain mobility in order to obtain the high proton conductivity through imidazole molecules in anhydrous system of PEMFC and thermochromic property of SPEEK thin film as a unique property.