Impedance Characteristics of Sulfonated Polysulfone Cation-Exchange Membrane Coated on a Rotating Disk Electrode

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Rotating disk electrode (RDE) is an effective tool for the study of electrochemical systems because the fluid flow is well defined and the uniform axial velocity yields a uniform mass-transfer-limited current density. The turbulent liquid flow, which is developed at such electrodes, gives rise to much thinner diffusion layer. In practice, RDE system has also been utilized in AC impedance analyses for thin films. In this study, impedance analysis of sulfonated polysulfone (sPSf) cation exchange membranes with various ion-exchange capacities was performed using RDE. The results showed that the impedance responses were mostly dependent upon the electrolyte concentration and the content of sulfonic acid groups ($-SO_3^-$) in the membrane at a given rotating speed. As ion-exchange capacity of the sPSf membrane increased, both the conductance and capacitance also increased. Moreover, DC polarization behavior of sPSf membrane was examined in this study. The results revealed that the electrochemical phenomena such as concentration polarization are predominantly dependent upon the interfacial properties of ion-exchange membrane.