

Preparation of solid proton conducting electrolytes for intermediate temperature fuel cell

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The proton conducting $\text{SiO}_2\text{-P}_2\text{O}_5\text{-TiO}_2$ and $\text{SiO}_2\text{-P}_2\text{O}_5\text{-ZrO}_2$ membranes were prepared by sol-gel technique. Proton(H^+) transport in solids has attracted much attention because of its potential use in clean energy fields, such as fuel cell, batteries and sensors. The sol-gel process have advantages not only easy cast technology but also better mixing of the starting materials which can be achieved on the molecular scale. The obtained membranes were porous, and the pore surfaces are terminated with hydroxyl bonds and absorb water in a humid atmosphere. The proposed mechanism for proton conduction in these membranes is the dissociation of protons from hydroxyl bonds and the proton hopping between hydroxyl and water molecules. Structural characterization were carried out using Fourier transform infrared spectroscopy, differential thermal analysis, thermal gravimetric analysis (TGA) and impedance measurements. A sample ($80\text{SiO}_2\text{-}10\text{P}_2\text{O}_5\text{-}10\text{TiO}_2$ mol%) was selected as the electrolyte for the H_2/O_2 fuel cell test and yielded the current density value from 0.23 to 0.05 mA/cm^2 at $\sim 300^\circ\text{C}$ under humidified atmosphere.