

## $\alpha$ -Zirconium Phosphate/Nafion Nanocomposite Electrolyte Membranes for Direct Methanol Fuel Cells

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The crucial problem to higher efficiency of direct methanol fuel cells (DMFCs) is methanol crossover of Nafion® membrane.  $\alpha$ -Zirconium phosphate ( $\alpha$ -ZrP) has been introduced to reduce the methanol crossover of Nafion. Exfoliated  $\alpha$ -ZrP can be obtained with ultra-sonication and basic surfactant (tetrabutylammonium hydroxide, TBA<sup>+</sup>OH<sup>-</sup>). Polyallylamine is used to render ionic bonding with  $\alpha$ -ZrP and Nafion. A novel  $\alpha$ -ZrP/Nafion nanocomposite electrolyte membrane was fabricated by coating the  $\alpha$ -ZrP/Nafion solution on Nafion® 117 membrane. By using X-ray diffraction (XRD) and transmission electron microscopy (TEM), it was found that  $\alpha$ -ZrP was well-dispersed in Nafion matrix. Scanning electron microscopy (SEM) measurements indicated that the nanocomposite layers have uniform thickness and good adhesion with Nafion® 117 membrane. There was a significant decreases in methanol permeability of the nanocomposite electrolyte membrane compared with Nafion® 117 membrane, while the proton conductivity of that was slightly less than that for Nafion® 117 membrane.