

Nanocomposite Membranes with Montmorillonite Fillers Functionalized with Various Sulfonic Acids

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Organic sultones and a perfluorinated sultone were grafted on the surface of montmorillonite (MMT) to render the organic sulfonic acid (HSO_3^-) functionality. The nanocomposite membranes were casted together with Nafion[®] using these functionalized MMTs as inorganic fillers. Grafting with the perfluorinated sultone was more efficient on the surface of MMT than with non-fluorine organic sultones. Montmorillonite functionalized with perfluorinated organic sulfonic acid also showed higher ion exchange capacity and ion conductivity, desired attributes to serve as an effective filler of a nanocomposite membrane with Nafion[®]. The nanocomposite membrane reduced the relative permeability of methanol in 3M solution by ca. 40%, while maintaining comparable ionic conductivity relative to pristine Nafion membrane. This leads to much enhanced performance of direct methanol fuel cell employing the Nafion[®]/sulfonated MMT nanocomposite membrane.