

Abstract

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Project Title : Graphene Oxide-Silane-Mordenite/Nafion Composite Membrane for Direct Ethanol Fuel Cell

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Abstract:

Alcohol crossover has been a crucial problem of direct alcohol fuel cell. Methanol or ethanol permeability through membrane has been controlled carefully by adding many types of fillers. Mordenite (MOR) and analcime (ANA) were selected to use as fillers for reduce alcohol cross over. They were synthesized in this work using many conditions. It was found that MOR and ANA were obtained with various size and crystallinity. However, all synthesized particle sizes were over 1 micrometer. MOR and ANA were then ground to reduce their sizes. They were then treated using 3-mercaptopropyl trimethoxysilane (MPTES). And they were used as fillers in Nafion and cast to composite membrane using solution casting method and spray method. The composite membranes were then tested for morphology, dispersion, solubility, ion exchange capacity, water uptake, proton conductivity, methanol permeability, and fuel cell performance. It was found that MOR showed better performance than ANA. Membranes with spray method showed also better dispersion and properties and also higher fuel cell performance.

MOR was then chosen to be treated with silane coupling agent and graphene oxide (GO) in the next stage. GO was successfully synthesized using modified Hummer's method. FTIR, TGA, XRD, SEM and EDX were used to prove the existence of GO. After that GO was successfully treated or coated onto MOR surface as proved. The methanol permeability of GO-MOR/Nafion was lower than those without GO or MOR. IEC, water uptake and methanol uptake were also better than those before modification. This was proved that it was suitable to use as composite membrane for direct alcohol fuel cell.

Keywords : Graphene oxide, Mordenite, Nafion, Composite membrane, fuel cell