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Nano Sized TiO₂ Filled Sulfonated Poly(ether ether ketone) Proton Conductive Composite Membrane for Direct Methanol Fuel Cells

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New organic-inorganic composite membranes based on sulfonated poly(ether ether ketone)/Titanium dioxide for application in the direct methanol fuel cell (DMFC) were synthesized. The membranes' water/methanol permeabilities were evaluated in pervaporation experiments and The proton conductivity and proton transport resistance were determined by impedance spectroscopy. The stability of the additive in the membrane is estimated by evaluating the membranes before and after successive immersions in 0.5 M sulfuric acid and deionized water, and estimating the weight loss of the membranes during such immersions. The results obtained show that the inorganic oxide network decreases the proton conductivity and water swelling. It is also found that increase in inorganic oxide content leads to decrease of methanol permeability. In terms of morphology, membranes are homogeneous and exhibit a good adhesion between inorganic domains and the polymer matrix. The properties of the composite membranes are compared with standard nafion membranes.