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Abstract

TITLE: MIcrowave Assisted In situ Synthesis of Proton Conducting Titanate Nanotubes into Nafion

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ABSTRACT BODY: The in situ synthesis of inorganic nanoparticles such as titania and silica by using the sol-gel method has been successfully reported previously in organic-inorganic hybrids. Such a technique takes advantage of the hydrophobic-hydrophilic phase-separated structure of ionomers as a template for in situ grow of finely dispersed inorganic particles. However, one disadvantage of the sol-gel method is the restriction for producing nanoparticles with new architectures such as nanotubes . In the present study, spherical titania nanoparticles incorporated in a ionomer-matrix composite were converted in situ to titanate nanotubes aiming at enhanced properties at high temperature (~130°C). Nafion-titania (anatase) hybrids produced by in situ sol-gel, with high inorganic phase content (~25 wt.%) and titania average particle size of ~5 nm, were used as a precursor. Hybrid membranes were immersed in a concentrated basic solution and a microwave-assisted hydrothermal treatment was carried out in a microwave oven at 150 °C for 180 min. Both the precursor and the modified composite membranes were characterized by X-ray diffraction (XRD), Raman spectroscopy (RS), small angle X-ray scattering (SAXS), and transmission electron microscopy (TEM). The experimental results revealed that the anatase precursor phase was successfully converted into the proton conducting titanate phase, as confirmed from XRD, RS , and TEM results. The composite membranes based on Nafion containing proton conducting fillers are envisioned as good candidates for the application as electrolytes in proton exchange membrane fuel cells operating at high temperature.