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PROPERTIES AND DEFC TESTS OF NAFION ADDED FUNCTIONALIZED TITANATE NANOTUBES PREPARED BY EXTRUSION

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Composite electrolyte membranes based on the incorporation of a second inorganic phase into ionomer matrices such as Nafion revealed to possess enhanced properties such as increased mechanical resistance and reduced permeability of solvents. It has been reported that surface functionalized titanate nanotubes (H2Ti3O7.nH2O) display a proton conductivity of ~ 10-2 Scm-1, which is attractive for the use of such composites in direct ethanol fuel cells (DEFC). Herein, composite membranes based on the addition of sulfonic acid groups functionalized titanate nanotubes into Nafion matrix were prepared by grafting followed by extrusion. These membranes were characterized by infrared spectroscopy (FTIR), Brunauer–Emmett–Teller (BET), acid-base titration, proton conductivity measurements and DEFC tests. FTIR measurements confirmed both the grafting of the titanate nanotubes. BET measurements showed that the functionalized titanate nanotubes possess a high surface specific area. Acid-base titration evidenced that additional sulfonic acid groups are present in the composite membranes compared to the pristine ionomer. The conductivity measurements show that the increase in the titanate nanotube volume fraction into the ionomers has not resulted in a decrease of the proton conductivity. The results show that the addition of functionalized titanate nanotubes into Nafion polymer matrix resulted in an improvement of the electric transport properties, reduction of the fuel crossover and, consequently, a higher DEFC performance for the composites were observed with respect to the pristine Nafion.