Phosphoric acid doped imidazolium polysulfone membranes for high temperature proton exchange membrane fuel cells - DTU Orbit (12/02/2019)

Phosphoric acid doped imidazolium polysulfone membranes for high temperature proton exchange membrane fuel cells

A novel acid–base polymer membrane is prepared by doping of imidazolium polysulfone with phosphoric acid for high temperature proton exchange membrane fuel cells. Polysulfone is first chloromethylated, followed by functionalization of the chloromethylated polysulfone with alkyl imidazoles i.e. methyl (MePSU), ethyl (EtPSU) and butyl (BuPSU) imidazoliums, as revealed by 1H NMR spectra. The imidazolium polysulfone membranes are then doped with phosphoric acid and used as a proton exchange membrane electrolyte in fuel cells. An acid doping level of about 10–11mol H3PO4 per mole of the imidazolium group is achieved in 85wt% H3PO4 at room temperature. The membranes exhibit a proton conductivity of 0.015–0.022Scm−1 at 130–150°C under 15mol% water vapor in air, and a tensile strength of 5–6MPa at 130°C under ambient humidity. Fuel cell tests show an open circuit voltage as high as 0.96V and a peak power density of 175–204mWcm−2 at 150°C with unhumidified hydrogen and air under ambient pressure.

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