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Influences of the structure of imidazolium pendants on the properties of polysulfone-based high temperature proton conducting membranes

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Abstract

Long-term stability is desired for developing high temperature proton conducting membranes as electrolytes for clean energy conversion of fuel cells. To understand the correlation of the grafted imidazolium structure and the stability of the polymer, six kinds of imidazolium polysulfones were synthesized from various imidazole compounds and the chloromethylated polysulfone, as proved by ^{1}H NMR and FT-IR spectra. Membranes with electron-withdrawing or long hydrophobic alkyl groups in the imidazolium pendants exhibited higher chemical stability than those with electron-donating short alkyl groups. After doping with phosphoric acid, the imidazolium polysulfone membranes showed acid doping levels of 8.2-13.0. The membrane with a long tail side-chain of decyl in the imidazolium pendant achieved the highest conductivity of 0.038 cm^{-1} at 160 ^{o}C without humidifying. Based on this membrane, fuel cell tests demonstrated the technical feasibility as the high temperature proton exchange membrane electrolyte in fuel cells.