Sulfonated copolyimide membranes derived from a novel diamine monomer with pendant benzimidazole groups for fuel cells - DTU Orbit (08/12/2018)

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Sulfonated polyimides are among the most interesting proton exchange membrane materials with high proton conductivity and good mechanical characteristics. As a major challenge the hydrolytic instability of the polymer backbone is addressed by introducing basic moieties in the polymer main chain. A series of sulfonated copolyimides (SPI) are prepared via random copolymerization of 1,4,5,8-naphthalenetetracarboxylic dianhydride (NTDA) with a new diamine monomer with pendant benzimidazole groups, 2,2′-bis(4-(1H-benzo[d]imidazol-2-yl)phenoxy)benzidine (BIPOB), and a sulfonated diamine monomer 4,4′-bis(4-aminophenoxy)biphenyl-3,3′-disulfonic acid (BAPBDS) at different diamine molar ratios (BAPBDS/BIPOB, 4/1, 6/1, 9/1 and 12/1). With ion exchange capacities in the range of 1.60-2.24 meq g(-1), transparent and ductile membranes are obtained by solution casting. The incorporation of benzimidazole pendant groups significantly improves the hydrolytic stability as well as the radical oxidative stability of the membranes. In addition, the SPI membranes exhibit high proton conductivities of 0.1 S cm(-1) in the fully hydrated state at 60 degrees C and high elastic modulus and tensile strength. Preliminary fuel cell tests demonstrate the technical feasibility and stability of the materials. (C) 2015 Elsevier B.V. All rights reserved.