Oxidative degradation of polybenzimidazole membranes as electrolytes for high temperature proton exchange membrane fuel cells

Polybenzimidazole membranes imbibed with acid are emerging as a suitable electrolyte material for high-temperature polymer electrolyte fuel cells. The oxidative stability of polybenzimidazole has been identified as an important issue for the long-term durability of such cells. In this paper the oxidative degradation of the polymer membrane was studied under the Fenton test conditions by the weight loss, intrinsic viscosity, size exclusion chromatography, scanning electron microscopy and Fourier transform infrared spectroscopy. During the Fenton test, significant weight losses depending on the initial molecular weight of the polymer were observed. At the same time, viscosity and SEC measurements revealed a steady decrease in molecular weight. The degradation of acid doped PBI membranes under Fenton test conditions is proposed to start by the attack of hydroxyl radicals at the carbon atom linking imidazole ring and benzenoid ring, which may eventually lead to the imidazole ring opening and formation of small molecules and terminal groups for further oxidation by an endpoint oxidation. Copyright © 2011 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.