



Fuel Cells I (Advances in Polymer Science)

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The concept to utilize an ion-conducting polymer membrane as a solid polymer electrolyte offers several advantages regarding the design and operation of an electrochemical cell, as outlined in Volume 215, Chapter 1 (L. Gubler, G.G. Scherer). Essentially, the solvent and/or transport medium, e.g., H_2O for the mobile ionic species, e.g., H^+ for a cation exchange membrane, is taken up by and confined into the nano-dimensional morphology of the ion-containing domains of the polymer. As a consequence, a phase separation into a hydrophilic ion-containing solvent phase and a hydrophobic polymer backbone phase establishes. Because of the narrow solid electrolyte gap in these cells, low ohmic losses reducing the overall cell voltage can be achieved, even at high current densities. This concept was applied to fuel cell technology at a very early stage; however, performance and reliability of the cells were low due to the dissatisfying membrane properties at that time. The development of perfluoro sulfonate and carboxylate-type membranes, in particular for the chlor-alkali process, directly fostered the further development of proton-conducting membranes and, as a consequence, also the progress in this type of fuel cell technology (polymer electrolyte fuel cell, PEFC).

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