High-Temperature PEM Fuel Cells: Electrolytes, Cells, and Stacks

C. Wannek

High-Temperature PEM Fuel Cells: Electrolytes, Cells, and Stacks

Christoph Wannek

Abstract

Although today, most of the technical requirements which are considered to be relevant before classical (Nafion®-based) low temperature polymer electrolyte membrane (PEM) fuel cells can compete successfully with existing technologies on the market place are already met, at least on the laboratory scale, there are important research efforts to design cells with an operating temperature well above today's 80 °C. Basically, such high-temperature PEM fuel cells could benefit from accelerated electrode kinetics, a simplified system design and a higher tolerance towards impurities in the hydrogen fuel. This paper reviews the stateof-the-art in basic science and industrial development of membranes, electrodes and stacks and points out the main challenges for future development. It first describes various approaches to increase the operating temperature of classical membrane materials up to 120_C, before it focuses on the development of phosphoric acid-doped polybenzimidazoles-type membrane cells that operate at 160–180_C. As the technology readiness levels of alternative electrolytes such as phosphonic acids, ionic liquids, acidic salts and mixed oxides are still very low, they will be described only very briefly.