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MATERIALS FOR INTERMEDIATE-TEMPERATURE SOLID OXIDE FUEL CELLS AND FOR PROTON EXCHANGE MEMBRANE FUEL CELLS

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Abstract

In the past decades the utilization of renewable energy sources is attracting widespread attention. A very attractive renewable energy conversion system is the fuel cell, which converts chemical energy directly into electrical energy with high efficiencies and, if hydrogen is used as fuel, absence of any emission of carbon dioxide.
Of the different types of fuel cells, the Solid Oxide Fuel Cell (SOFC) and the Proton Exchange Membrane Fuel Cell (PEMFC) are very convenient for widespread application. The SOFC is most suitable for stationary applications, while the PEMFC is more appropriate for mobile applications. Before these cells are attractive to be used at large-scale, the operation conditions and efficiencies have to be optimized.
The present SOFC consists of an yttria-stabilized zirconia (YSZ) electrolyte, a strontium-doped lanthanum manganite (LSM) cathode and a Ni-YSZ cermet anode and operates around 1000 ºC. The cell characteristics and long-term stability of the SOFC are improved by reducing the operating temperature to about 700 ºC. To realize this intermediate operating temperature, alternative materials are necessary.
The PEMFC consists of a water-saturated proton conducting Nafion electrolyte and electrodes composed of Nafion, platinum and carbon and operates, due to the crucial need of water of the electrolyte, at a maximum temperature of 80 ºC. Because of a higher reaction rate and increased tolerance to carbon monoxide, the cell performance can be improved by increasing the operating temperature to about 160 ºC. At this temperature, the Nafion electrolyte has, due to absence of water in the membrane, very low proton conductivity and has, therefore, to be modified or replaced by another proton conductor.
In this review, recent research on materials for intermediate-temperature Solid Oxide and Proton Exchange Membrane Fuel Cells is presented.

*Keywords***:** SOFC, PEMFC, intermediate temperature, materials

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