DOI: 10.4172/2576-1463-C1-001

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Promising oxy borates for solid-oxide fuel cell applications

The research on solid oxide fuel cell (H^+ or O^{2-} SOFC) is based on both the synthesis of new materials and the design process of the cell. e main advantage of SOFC is that they can work under hydrocarbon fuel at temperature higher than 700°C. In the current SOFC systems, the most widely used electrolyte is yttria-stabilized zirconia (YSZ) which is inexpensive and shows a acceptable conductivity level. But YSZ is very refractory and its major drawback is its reactivity during the sintering process with lanthanum- and strontium-based cathode materials, which leads to the formation of an insulating layer such as $SrZrO_3$ or $La_2Zr_2O_7$. ere is also a great interest to nd ceramic based fuel cells, for mobile application, working at low temperature (400°C). is can be achieved in H^+-SOFC with a ceramic membrane showing a good proton conductivity level. e state of the art perovskite type yttrium-doped $BaCeO_3$ (called BCY) shows a proton conductivity level above 1 mS/cm at 400°C. But due to its high basicity, BCY tends to decompose, in this temperature domain, in air containing CO_2. Finding new electrolyte material is one of the issues. In this presentation, a er a brie y state-of-the art concerning SOFC electrolyte, we will report on high-temperature proton and oxide ion conductivities in two new class of oxyborates $La_{26}O_{27}(BO_3)_8$ and doped $Ba_3Ti_3O_6(BO_3)_2$ compounds. Both samples were prepared by solid-state reaction and characterized using x-ray di raction and electrochemical impedance spectroscopy. Quite high conductivity level, about 6.8×10^{-4} and 1.5×10^{-4} S/cm at 700°C in air were observed respectively. e transport properties can be understood in terms of the presence in high concentrations of oxygen and barium vacancies as well as oxygen interstitials a observed in hybrid density-functional defect calculations.

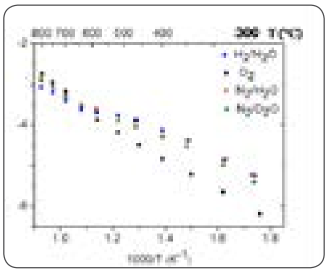

Figure 1: Conductivity vs. temperature of the oxyborate $La_{26}O_{27}(BO_3)_8$ under different atmospheres

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