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On the use of BaCe0.85Y0.15O3-d as a multi-functional ingredient in solid oxide fuel cells

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Solid oxide fuel cells (SOFCs) offer a promising green technology of direct conversion of chemical energy of fuel into electricity. Barium cerates with Y-substitution at the Ce site, $BaCe_{1−x}Y_xO_{3−\delta}$, are well known for excellent conduction capabilities in the temperature range 400–800 ℃ as a result of the proton motion in the crystal lattice. We report on oxygen-deficient $BaCe0.85Y0.15O3-d$ (BCY15) perovskites for which specialized impedance measurements discovered promising mixed ion (proton and oxide ion) conductivity at the intermediate operating temperatures. To realize a "monolithic design", which strongly simplifies the technology was proposed based on the introduction of a separate compartment (central membrane) for the water formation and evacuation. It has mixed ionic (proton and oxide ion) conductivity and porous structure since in O_2 flow BCY15 is an oxide ion conductor, in H_2 flow it is proton-conducting and in the central membrane, it is mixed ion-conducting. The characterization of the chemical composition and stability, oxygen stoichiometry and cationic ratios is known of great importance for understanding the defect-chemistry that would govern the transport properties. The structural details of powder, dense and porous samples of materials based on $BaCe0.85Y0.15O3−\delta$ (BCY15) were investigated from full profile analysis of neutron and x-ray diffraction patterns. The materials operated satisfactorily as cathode, anode and central membrane in a test monolithic SOFC.

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