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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, BaCe1−xYxO3−δ, 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 O2 flow BCY15 is an oxide ion conductor, in H2 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−δ (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.

Primary author: KREZHOV, Kiril (IE and INRNE, BAS, Bulgaria)

Co-authors: Prof. VLADIKOVA, Daria (Institute of Electrochemistry and Energy Systems, BAS); Ms MALAKOVA, Tanya (INSTITUTE OF ELECTRONICS, BAS); Dr RAIKOVA, Gergana (Institute of Electrochemistry and Energy Systems, BAS); Dr GENOV, Ivailo (IEES-BAS)

Presenter: KREZHOV, Kiril (IE and INRNE, BAS, Bulgaria)

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