

ENERGY AND MATERIALS RESEARCH

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Synthesis and characterization of nanomaterials for solid oxide fuel cells

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Solid oxide fuel cells (SOFCs) are a class of fuel cells characterized by the use of a solid material as the electrolyte. SOFCs use a solid electrolyte to conduct negative oxygen ions from the cathode to the anode. The electrochemical oxidation of the oxygen ions with hydrogen or carbon monoxide thus occurs on the anode side. The purpose of this presentation is to discuss the synthesis and characterization methods of nanomaterials for electrolytes in solid oxide fuel cells.

Synthesis: One of the efficient methods for the synthesis of nano particles is the modified combustion technique. In this method stoichiometric amounts of chemicals are made in to a solution and heated. The solution boils and undergoes dehydration followed by decomposition leading to a smooth deflation producing foam. On persistent heating, the foam gets auto-ignited due to self-propagating combustion, giving a voluminous fluffy nanopowder. The obtained powder is annealed in oxygen atmosphere below 700°C to eliminate the trace amount of organic impurity that may remain in the sample.

Characterization: Structure of the as-prepared powder can be identified by the powder X-ray diffraction (XRD) technique and the particle size using transmission electron microscopy. The powder can be pressed into disc pellets of thickness 2 mm using a hydraulic press with a pressure of 100 MPa, and then sintered at optimized temperatures. The surface morphology of the sample is analyzed using scanning electron microscopy (SEM). The impedance spectroscopic study is carried out by making the pellet in the form of a disc capacitor.

Conclusion & Significance: The impedance spectroscopic studies establish the feasibility of the materials to use as an electrolyte in SOFCs.

Biography

Sam Solomon is working as an Associate Professor in the Department of Physics, Mar Ivanios College, and Thiruvananthapuram, India. He has MSc in Physics and PhD in microwave materials. He received the Junior Research Fellowship from the Council of Scientific and Industrial Research - India in 1992, Dr S Vasudev award for the best major research project from the Council of Science and Technology in 2008 and the Post-doctoral Research Award from the University Grants Commission in 2009. He was selected by the University of Kerala for the Commonwealth Fellowship in 2005. He has 83 papers in reputed journals and more than 50 conference presentations. He supervised six PhD and is a reviewer of Elsevier and Springer publications.

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