Superior oxide-ion conducting thin film electrolytes for low temperature μSOFC operation

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Last advances in the development of micro Solid Oxide Fuel Cells (μSOFC) have been connected with the downscaling of traditional SOFC functional layers to thin films, together with their integration in silicon technology. Classical restrictions of SOFC could be overcome, being able to lower the operating temperature to 400ºC. Despite such important leap, the technology encountered a new dilemma, since fast degradation was still found on the utilized metallic electrodes, but further lowering down was hindered by the internal resistance of the electrolyte. Operating at lower temperatures is desired, since it would not only allow a safe and stable use of metals, but would also facilitate an easier integration in real devices. For that, electrolyte materials with superior oxide-ion conduction need to be investigated. Here, we present the optimization of $Bi_2V_{0.9}Cu_{0.1}O_{5.35}$ (BICUVOX) as a thin film electrolyte for μSOFC. Despite its high ionic conductivity, a poor chemical stability and low compatibility with other components of the cells have traditionally impeded its utilization in classical SOFC. However, the use of thin films and in a new low temperature range could solve the problem. A complete structural and electrochemical characterization of BICUVOX films deposited by pulsed laser deposition has been carried out, aiming to stabilize the high conducting aurivillus tetragonal phase. Best performing films showed the potential use of this material at temperatures as low as 250ºC.