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The effect of oxygen pressure on structure, electrical conductivity and oxygen permeability of $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ thin films by pulsed laser deposition

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Abstract

In this paper, $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$ (BSCF) thin films were deposited on single crystal $SrTiO_3$ (STO) (100) by pulsed laser deposition (PLD) technique at different pressures of oxygen. Crystal structure of bulk and thin film samples was studied by x-ray diffraction (XRD). The XRD results indicate that both bulk and thin film samples have cubic structures. AFM micrographs showed an increase in RMS roughness by oxygen pressure. The electrical resistance was measured at room temperature up to 600 and 800 °C in air using four probe method for bulk and thin films, respectively. A sharp drop in resistance was observed by increasing temperature up to 400 °C, that was explained with the small polaron hopping model. Polaron activation energy was calculated by Arrhenius relation. It was decreased over increasing oxygen pressure. The surface exchange coefficient (K_{chem}) of the 300 mTorr sample was measured by electrical conductivity relaxation (ECR) technique. The results suggested a linear relationship between K_{chem} and reciprocal of absolute temperature.

Keywords: solid oxide fuel cell, cathode, thin film, pulsed laser deposition

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