Structural, Morphological and Spectral Properties of $La_2Mo_2O_9$ Thin Films Synthesized by Spray Pyrolysis Technique

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Abstract: *The $La_2Mo_2O_9$ (LAMOX) thin films were prepared successfully by using chemical spray pyrolysis method and annealed at 1000 °C for two hours. LAMOX thin films were characterized by XRD, FESEM and EDAX tools. X-ray diffraction result shows the increase in crystallite size with deposition temperature LAMOX thin film. The morphological investigation were done by analyzing FESEM. It is shows that, increase in grain size after the annealing. The investigated LAMOX are potential application as an electrolyte for solid oxide fuel cell.*

Keywords: LAMOX, XRD, FESEM, EDAX.

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1. Introduction

From the discovery of $La_2Mo_2O_9$ (LAMOX) material, it plays a crucial role in the application of solid oxide fuel cell (SOFC) as an electrolyte because of its oxide ion conductivity at intermediate temperature [1-3]. La^{3+} based compounds also shows beneficial parameters for SOFC applications [4, 5]. The most important factor affecting on the performance of electrolyte is their oxygen ion conductivity. Before the discovery of LAMOX the YSZ (Yttria Stabilized Zirconia) used as electrolyte having good ionic conductivity 0.1 S cm^{-1} at 1000 °C [6]. YSZ necessitates not only costly interconnects but also contributes into cell ohmic loss, raising the cost of fuel cells. Lacorre et al. [7] discovered LAMOX family of oxygen ion conductors in the 2000. The function of LAMOX is based on concept of lone pair substitution (LPS) [8].

At intermediate temperatures, LAMOX has higher oxygen ion conduction ability than YSZ [7]. Fournier et al. synthesized the first $La_2Mo_2O_9$ compound in 1970. At around 580 °C, the compound phase transition from monoclinic to cubic phase [9, 10]. Fast oxide-ion conductors, has their potential applications in SOFC, oxygen sensors, and oxygen pumping devices [11-15]. The phase transition of LAMOX takes place near about 580 °C from α-monoclinic to β-cubic phase with enhancing ionic conductivity of order twice magnitude leading high ionic conductivity than YSZ. The ionic conductivity of electrolyte can be also enhanced by reducing the thickness of electrolyte or by discovering another type of electrolyte having high oxide ion conduction ability. Therefor the LAMOX reported as another fast oxide ion conductor used as an electrolyte material for solid oxide fuel cell [16].

2. Experimental

2.1. Synthesis of LAMOX thin films

The spray pyrolysis route was employed to deposit LAMOX thin films on an alumina (Al_2O_3) and glass substrates. The following analytical grade chemicals were directly used for the synthesis of $La_2Mo_2O_9$ (LAMOX) thin films without any further