PERFORMANCE AND DEVELOPMENT OF PEROVSKITE CATHODE WITH APPLICATION TOWARDS GAS PURIFICATION

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ABSTRACT

Solid Oxide Fuel Cell is one of the most advantages fuel cell as it is low pollutant emission, low noise, easy to produce and high energy performance. The research developed based on SOFC is to reduce its operating temperature as high temperature will reduce the performance of the cell. One of the most used material to make SOFC is Lanthanum Strontium Cobalt Ferrite (LSCF). LSCF is mixed with starch and Polyvinyl Alcohol as binder to be made into pellet which then will be sintered at temperature range of 600˚C to 750˚C which are the right temperature range for this study as temperature over 800˚C is said to be damaging the materials and therefore reducing the performance of the cathode. The samples will be tested using the X-ray Diffraction (XRD). The electrical conductivity was measured using the Electrochemical Impedance Spectrometer (EIS). For the XRD data, it can be concluded that the size of the particle increases as the temperature increases from 31.18 nm to 38.64 nm. The size starts to decrease to 36.33 nm at 750˚C. Based on the XRD profile, it can see that the highest peak for all different sintering temperature are around 2θ= 32˚ suggesting that they are of the same purity of metal and perovskite structure. For the EIS data profile, the electrical conductivity increase at 600˚C to 700˚ from 4.4987x10-5 Ω/cm to 7.7916x10-5 Ω/cm and then decreases at 750˚C to 6.8640x10-5 Ω/cm. It is evident that the increase in electrical conductivity of the fabricated LSCF is parallel with the literature report. The findings are indicating that the pellet is starting to degrade at temperature 750˚C.

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CHAPTER 1

INTRODUCTION

1.0 BACKGROUND STUDY

The rapid technological advances demand for the search of novel materials with special properties for specific applications. The excessive and fast utilization of natural energy (fossil fuel) has set off a worldwide energy challenges from both ecological also, industrial sides. Moreover, the expanding request of energy use on the planet commits researchers to discover options to survive and go up against the showed up issues (Abdalla, Hossain, Azad, & Petra, 2018). Oxygen and oxygen-enhanced air are essential for various industrial and medicinal applications. For instance, they can be utilized to enhance the efficiencies of combustion processes and lead to a decrease in carbon monoxide or on the other hand hydrocarbons in the exhausts. To acquire high purity of oxygen in substantial scale, cryogenic air separation is the main financially accessible method, which is known for its significant disadvantage of high energy utilization. The substitutions of the cryogenic air separation with different energy consuming oxygen separation techniques have been investigated for a long time. For example, this method can be used to produce pure Nitrogen and Oxygen gas that can be used for a lot of applications (Lin, 2006).

One important class of such compounds with wide applications is the perovskite oxide. Lanthanum perovskite offers a wide field of research due to its intriguing structural, electronic and magnetic properties (Ghogomu, Nforna, & Lambi, 2016). The synthesis of LSF, LSM and LSCF in different forms such as thin films, nanopowders, nano composites with various properties are valid as cathode materials for solid oxide fuel cells (SOFCs). Solid oxide fuel cells are devices which offer renewable energy and many advantages compare to other energy sources (Baharuddin, Rahman, & Muchtar,