

Characterization of LaSrCoFeO_3 cathode material prepared with the aid of functionalized carbon nanotubes for proton conducting fuel cell

Abstract

A $\text{La}_{0.6}\text{Sr}_{0.4}\text{Co}_{0.2}\text{Fe}_{0.8}\text{O}_{3-\delta}$ (LSCF) cathode material was synthesized via a modified sol-gel method using metal nitrate-salts assisted with four different weight ratios of functionalized carbon nanotubes (f-CNTs). As-prepared sample was undergo calcination process at 900°C for 5 hours and then characterized using X-ray diffractometer (XRD) and Brunauer-Emmet-Teller (BET). The LSCF powder prepared with the best weight ratio was mixed with binder to form a cathode slurry, and then coated on both side of the $\text{BaCe}_{0.54}\text{Zr}_{0.36}\text{Y}_{0.1}\text{O}_{2.95}$ (BCZY) electrolyte pellet that served as a support. The fabricated cell was subjected to an electrochemical impedance spectroscopy (EIS) and scanning electron microscope (SEM) for electrical and surface morphology studies. Clearly seen from the XRD patterns, all the samples exhibited single phase with orthorhombic structure (JCPDS-00-089-1268). However, the highest surface area was found for LSCF modified with 4mg f-CNTs. For electrochemical study, the area specific resistance (ASR) of the half-cell was two times lower as compared to pristine-LSCF (ASR= $0.375 \omega\text{cm}^2$ and $0.675 \omega\text{cm}^2$). The SEM images clearly showed a good contact between the electrolyte and cathode after the EIS measurement with no sign of crack and delamination for the best sample. Thus, the additional of 4mg f-CNTs as a dispersing agent in the sol-gel routes has successfully produced a good quality cathode that needed for high performance proton conducting fuel cell (PCFC).