Low Cost Electrode Materials for the Molten Carbonate Fuel Cell

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The most common method of storing energy in an electrochemical cell is in the form of chemical energy. A fuel cell is an electrochemical energy conversion device, which converts chemical energy directly into electrical energy. Molten Carbonate Fuel Cells (MCFC) have attracted wide attention due to promising characteristics for large-scale electric power generation.

This work is based on synthesis and electrically characterization of low cost electrode materials for the Molten Carbonate Fuel Cell (MCFC). At present, the dissolution of the state-of-the-art lithiated nickel oxide cathode material is a most crucial lifetime limiting factor and the major obstacle for the commercialization of MCFC. A solid solution consisting of $LiCoO_2$ and NiO is expected to posses some of the desirable properties of these two materials. $LiCoO_2$ and NiO in the solid solution are expected to lower its resistivity and $LiCoO_2$ is expected the decrease the dissolution of lithiated nickel oxide cathode.

In this study, powder compositions in the NiO-$LiCoO_2$ binary system were prepaired by the glycine nitrate method. The electrical conductivity of these materials was determined by performing d.c. conductivity measurements on sintered pellets by the four-probe method. The conductivity measurements were performed in a cyclic manner on heating and cooling in air, in the temperature range, 25 - 750 °C.

The pressing study shows that there is an optimum pressure to obtain the sintered pellet at the highest density. In this study the optimum pressing pressure for NiO system is determined as 150 MPa. The electrical conductivity study shows the ability of obtaining NiO-$LiCoO_2$ binary materials with appropriate electrical conductivity obove 1 S/cm for the MCFC cathode. Futher, the significantly high room temperature conductivity of these materials indicates the potentiality of them for electrodes in room temperature applications such in re-chargeable Li - ion batteries.

Key words: fuel cells, Molton carbonate fuel cell, Electrode materials, Cathodes, binary oxides