Performance of low-temperature solid oxide fuel cells were improved through fabrication methods

Title of the dissertation
Fabrication and electrochemical performance analysis of nanocomposite for low-temperature SOFC

Contents of the dissertation
The thesis deals with low-temperature solid oxide fuel cells (LTSOFC), which convert chemical energy into electrical energy. The benefits of LTSOFC is a low operating temperature, relatively high energy conversion efficiency, and potentially low costs. Key challenges with LTSOFC is the power density and the ionic conductivity of the electrolyte.

In this thesis, several different synthetic and fabrication processes, such as co-precipitation synthesis, freeze-drying synthesis, and spark plasma sintering (SPS) techniques, were employed to enhance the performance of the composite electrolyte for LTSOFC. Samarium-doped ceria (SDC) was employed, which was also modified by adding a carbonate element (CSDC). A LiNiCuZn electrode composite was utilized. The ionic conductivity of the electrolyte could be improved via freeze-drying and SPS methods as opposed to the co-precipitation method. The highest power density obtained was 1 W/cm² at 470 °C. The best ionic conductivities were obtained by freeze-drying and the SPS, which exceeded 0.4 S/cm. In a carbonate-SDC electrolyte, adding CO2 to the air oxidant clearly improved the power density and the open circuit voltage of the fuel cell.

Field of the dissertation
Engineering physics, Fuel cells

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