Characteristics and performance of Samarium-doped Ceria-$(Li/K)_2CO_3$ composite electrolytes for low temperature Solid Oxide Fuel Cells (LTSOFCs)

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In recent years, a new type of electrolyte materials has been developed for the application of LTSOFCs. These composite materials were found to conduct both oxygen ion and proton during the fuel cell environment, thus result in high performance. Then my research focused on the morphology, conductivity and performance of the composite of samarium doped ceria and a binary carbonate eutectic (62mol%Li_2CO_3/38mol%K_2CO_3) in various weight ratios (1%, 5%, 10%, 20%). Based on the porosity value, the composite with 20wt% of carbonate salt is selected to continue the other experiments (porosity < 5%). The morphology study presents the composition can prevent SDC particles from agglomeration. The conductivity is measured under air condition relates to the superionic phase transition in the interface phases between SDC and carbonates. The maximum conductivity can get 0.33Scm^{-1} at 600°C. Single cells with the composite electrolyte are fabricated by cold-press method using NiO/SDC as anode and LSCF ($La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_3$) as cathode. The cell shows a maximum power density of 550$mWcm^{-2}$ at 600°C, using hydrogen as the fuel and air as the oxidant.