Reducing the sintering temperature of solid oxide fuel cells by controlling the shape of ceria-based eletrolyte nanoparticles

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solid oxide fuel cells; nanoparticles, shape control

Impact statement
The broad impact is the reduction of cost and enhanced performance of intermediate temperature solid oxide fuel cells. Specific impacts are related to the development of cost competitive synthesis methods that allow for the sintering of dense ceria-based electrolytes (> 93% of theoretical density)at temperatures below 1200 C.

Highlights
A simple chemical method was developed for producing ceria-based nanoparticles with high sintering activity. Sintering of dense gadolinia-doped ceria electrolytes at 1150C Fuel cell tested underH2 showed promising performance

Abstract
The development of solid oxide fuel cells operating at intermediate temperature (IT-SOFCs) and using carbonaceous fuels to generate power have been crucial for the widespread commercialization of SOFCs. Gadolinium-doped cerium oxide (CGO) is known to display the desired properties to be used both as a high ionic conductor electrolyte at intermediate temperatures and as an active layer in the anode due to its catalytic properties for the decomposition of fuels containing hydrocarbons. In this study IT-SOFCs were fabricated with highly reactive nanorods of CGO electrolyte powder with shape controlled by a hydrothermal synthesis developed in this project. The tested fuel cell system consists of the CGO electrolyte support, lanthanum strontium cobalt ferrite (LSCF) cathode and Ni/CGO anode. The performance of the cell was evaluated with hydrogen as a fuel and air as an oxidant at temperatures between 500–700 °C, further work will be carried out to evaluated the performance of the cell when operating with natural gas. The experimental results indicate that a high-performance IT-SOFC can be obtained with a relatively low temperature (1.150 C) two-step sintering of the ceria-based layers.