Improved sinterability and conductivity enhancement of 10-mol% calcium-doped ceria using different fuel-aided combustion reactions and its structural characterisation

ABSTRACT

Cubic fluorite structure of ceria doped with 10-mol% calcium, Ce0.9Ca0.1O1.9, was prepared using fuel-aided combustion techniques, utilising glycine, urea and citric acid as fuels along with metal nitrates as the oxidiser. The influence of fuel utilised on the combustion process and on physiochemical properties was thoroughly studied. The results of X-ray diffraction showed that all powders calcined at 400°C were of single phase with cubic fluorite structure. Conductivity optimisation was achieved via ceramic sintering at various temperatures within 1000ï 1200°C. The results showed that Ce0.9Ca0.1O1.9 ceramic prepared using citric acid-aided combustion synthesis had higher ionic conductivity, ůß00°c = 0.017 S cmī 1, and lower activation energy, Ea = 0.84 eV, compared to Ce0.9Ca0.1O1.9 ceramics prepared using glycine and urea. The scanning electron microscopy (SEM) results showed that pellets sintered at 1200°C were dense, and the relative densities of these pellets were over 95%, determined using the Archimedes method.

Keyword: Intermediate temperature solid oxide fuel cell (IT-SOFC); Combustion; CeO2; Ceramics; Electrical properties; Impedance