Low temperature synthesis of gadolinium-doped cerium oxide nanoparticles

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In this study, a green chemistry route for the synthesis of gadolinium-doped ceria (GDC) nanoparticles is reported. The aqueous based reflux method uses nitrates of both ceria and gadolinium and hexamethylenetetramine as starting materials to produce GDC at 80 ºC. As-produced powders were found to be crystalline fluorite-type structure GDC before any heat treatment, with crystallite size ≤ 10 nm, as inferred by X-rays diffraction analyses. Energy dispersive X-ray spectroscopy data revealed that GDC powders, with gadolinium concentration in the 0 - 20 mol% range, have composition close to the nominal values, within the experimental error. Thermogravimetric analyses (TG) evidenced that main mass loss (~7%) occurs at < 400 °C. Sintering behavior was studied by dilatometry of cylindrical pellets pressed using both as-produced and calcined (400 °C for 1 hour in air) powders. The retraction profile of the as-produced samples resembles the TG data, showing plateaus that correspond to the observed mass loss events. On the other hand, sintering of calcined samples exhibited onset of shrinkage at T ~ 600 °C and a continuous retraction up to 1400°C (~17% total retraction). The experimental results indicate that the synthesis method results in GDC with good properties for application in electrochemical devices, such as fuel cells and solar-driven thermochemical reactors.

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References:

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