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Mechanosynthesis and structural characterization of nanocrystalline $Ce_{1-x}Y_xO_{2-\delta}$ (x = 0.1 – 0.35) solid solutions

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Abstract

A series of nanostructured fluorite-type $Ce_{1-x}Y_xO_{2-\delta}$ ($0 \leq x \leq 0.35$) solid solutions, prepared via high-energy milling of the CeO_2/Y_2O_3 mixtures, are investigated by XRD, HR-TEM, EDS and Raman spectroscopy. For the first time, complementary information on both the long-range and short-range structural features of mechanosynthesized $Ce_{1-x}Y_xO_{2-\delta}$, obtained by Rietveld analysis of XRD data and Raman spectroscopy, is provided. The lattice parameters of the as-prepared solid solutions decrease with increasing yttrium content. Rietveld refinements of the XRD data reveal increase in microstrains in the host ceria lattice as a consequence of yttrium incorporation. Raman spectra are directly affected by the presence of oxygen vacancies; their existence is evidenced by the presence of vibration modes at ~ 560 and ~ 600 cm^{-1}. The detailed spectroscopic investigations enable us to separate extrinsic and intrinsic origin of oxygen vacancies. It is demonstrated that mechanosynthesis

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