DEFECTS RELATED PROPERTIES IN NANOCRYSTALLINE $CE_{1-X}Y_XO_2$- (X 0.3) SOLID SOLUTIONS SYNTHESIZED VIA HIGH-ENERGY BALL MILLING

FABIÁN Martin, GIRMAN Vladimír, MENZEL Dirk, ŠEPELÁK Vladimír

Institute of Geotechnics SAS, Kosice, Slovakia, EU

Abstract

The cerium oxide (ceria, CeO_2) and ceria based materials become one of the most interesting ceramics from both fundamental and practical point of view. There is number of their practical applications such as catalysts, oxygen sensors, UV/VIS absorbers, electrolytes for SOFC´s, etc. Within the present work, the nanostructured fluorite-type $Ce_{1-x}Y_xO_2$- solid solutions with the average crystallite size below 20 nm are produced by high-energy ball milling of the $(1-x)CeO_2 + (x/2)Y_2O_3$ mixture for 90 min. The nanocrystalline nature of Ce1-xYxO_2- as well as a decrease in both interplanar distances and unit cell parameters as a consequence of Y_{3+} incorporation into the ceria lattice are evidenced by XRD and HR-TEM. The increase of Y_3+ concentration induces an increase in microstrains in host ceria lattice and suppresses the crystallite size growth. Raman spectroscopy indicates an increment in the concentration of intrinsic/extrinsic oxygen vacancies upon milling and Y_3+ doping. Broad photoluminiscence spectra confirm formation of defects. The latter is further confirmed by variation in optical properties of the materials. The microstructure features result in an enhanced room-temperature ferromagnetism of the nanostructured Ce1-xYxO_2- solid solutions.

Keywords: Ceria, Yttrium, Oxygen vacancies, Defects, Optical properties, Magnetism

Author did not supply full text of the paper/poster.