Title: Microstructure and electrical transport phenomenon of yttria alloyed nanocrystalline ceria solid solution synthesized by mechanical alloying

Author: S. Dutta S. Bandyopadhyay A. Dutta S.K. Pradhan

PII: S0025-5408(16)31936-5
DOI: http://dx.doi.org/doi:10.1016/j.materresbull.2017.05.028
Reference: MRB 9343

To appear in: *MRB*

Received date: 3-11-2016
Revised date: 4-5-2017
Accepted date: 10-5-2017

Please cite this article as: S. Dutta, S. Bandyopadhyay, A. Dutta, S.K. Pradhan, Microstructure and electrical transport phenomenon of yttria alloyed nanocrystalline ceria solid solution synthesized by mechanical alloying, *Materials Research Bulletin* (2017), http://dx.doi.org/10.1016/j.materresbull.2017.05.028

Microstructure and electrical transport phenomenon of yttria alloyed nanocrystalline ceria solid solution synthesized by mechanical alloying

S. Dutta, S. Bandyopadhyay, A. Dutta, S. K. Pradhan*

Department of Physics, The University of Burdwan, West Bengal, India-713104

*Corresponding author, e-mail: skpradhan@phys.buruniv.ac.in

Abstract:

This article reports the room temperature synthesis of nanocrystalline (4-20 mol%) yttria (Y_2O_3) alloyed ceria (CeO_2)-based solid solutions in open air employing a single step mechanical alloying technique. Structure and microstructure of these compounds have been investigated and the effect of yttria on the electrical transport phenomenon of these compounds is revealed. Structure and microstructure characterizations of all alloyed compounds are carried out in detail employing Rietveld refinement method by analyzing respective XRD patterns. Ionic conductivities of all these compounds are measured in open air in the temperature range 633K-833K. For unsintered samples, conductivity increases continuously with increase in alloying concentrations up to 12 mol% of Y_2O_3, which is higher than the alloying concentration synthesized by any other method. However, the total conductivity reaches maximum with 8 mol% of Y_2O_3 when the samples are sintered and exhibits the highest conductivity of ~ 3.8×10^{-3} $\Omega^{-1}cm^{-1}$ at 813K. Electrical relaxation process and transport phenomenon of all compounds are studied by impedance spectroscopy and complex modulus analysis. Presence of thermally activated relaxation and hopping mechanism in the system are also confirmed and correlated