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Investigation of magnetic, morphological, structural, stability and optical properties of Ce3+ and Cu2+ co-doping in ZnO.

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Key words: Semiconductors, Electronic structure, Magnetic Properties, Optical properties
Abstract: Ce3+, Cu2+ co-doped ZnO (Zn1_2xCexCux O: x¼0.00, 0.01, 0.02, 0.03, 0.04 and 0.05) nanocrystals were synthesized by the use of sol-gel technique. These nanocrystals were investigated by using X-ray diffraction (XRD), UV–visible diffuse reflectance spectroscopy (DRS), scanning electron microscopy (SEM), High-resolution transmission electron microscope (HR-TEM) and selected area electron diffraction (SAED). The stability and magnetic properties of Ce3+ and Cu2+ co-doped ZnO were probed by first principle calculations. XRD results revealed that all the compositions are single crystalline, hexagonal wurtzite structure. The optical band gap of pure ZnO was found to be 3.22 eV, which was in agreement with other experimental findings [1, 2] and it decreased from 3.22 to 3.10 eV with an increase in the concentration of Cu2+ and Ce3+ content. The morphologies of Ce3+ and Cu2+ co-doped ZnO samples confirmed the formation of nanocrystals with an average grain size ranging from 70 to 150 nm. The ab initio magnetization calculations results affirmed the antiferro and ferromagnetic state for Ce3+ and Cu2+ co-doped ZnO structure.
Reference: [1] J.F. Chang, W.C. Lin, M.H. Hon, Appl. Surf. Sci. 183 (2001) 18.
[2] I. Djerdj, Z. Jaglicic, D. Arconde, M. Niederberger, , Nanoscale 2 (2010) 1096.

Summary

Ce, Cuco-dopedZnOnanocrystals weresuccessfullysynthesizedbya microwavecombustionmethod.
With Ce–Cu co-doping,crystallite size, latticeparametersandstrainof ZnO changes.
The bandgapofthesynthesized samples hasbeenvariedintherange of 3.15–3.10eV.
The grainsizeofthesampleisde-creased withtheincreaseinCe–Cu co-doping.
The magnetizationmeasurements result intoferroandantiferromag-netic stateforallco-dopedsamples which isinagreementwith first principles theoreticalcalculations

Apply to be
 considered for a student
   award (Yes / No)?

YES

Level for award
 (Hons, MSc,
   PhD, N/A)?

PhD

Main supervisor (name and email)
and his / her institution

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