Contribution ID: **325** Type: **Oral Presentation**

Effects of Cr3+ mol% on the structure and optical properties of the ZnAl2O4:Cr3+ nanocrystals synthesized using sol-gel process

Tuesday, 8 July 2014 14:00 (20 minutes)

Abstract content
   (Max 300 words)
Formatting &
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Zinc aluminate (ZnAl2O4) hosts and ZnAl2O4:Cr3+ doped were successfully prepared at a relatively low temperature (˜80 ℃) using the sol–gel method. The dopant (Cr3+) mol% was varied at a range of 0 – 0.3 mol%. The main aim was to produce phosphor material that can be used for the down-conversion in UV devices. The annealed powder samples were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), UV and photoluminescence (PL). The XRD data revealed that all annealed samples consist of the cubic ZnAl2O4 structure. The estimated crystallites sizes were in the range of 22 – 23 nm in diameter. The results showed that there is an optimum Cr3+ mol% for the system to deviate from Vergard's law. The surface morphology of the phosphors was influenced by the Cr3+ mol%. UV results showed that the Cr3+ mol% affects the band gap of the host. The PL results showed that the host and the Cr3+-doped nanoparticles exhibit violet emission slightly at different peak positions. Slight peak shifts suggests that the luminescence can originate from the host or Cr3+ ion. Emission from the host is attributed to the band-gap defects in the host material, while the emission from the Cr3+ is attributed to the 4T1 → 4A2 transition. At the higher mol% there is an emission at 692 nm, which is attributed to the 2E → 4A2 transition in Cr3+. The incorporation of the foreign atoms (Cr3+) at the lower mol% seems to be affecting the defects level and population. Both the luminescence enhancement and quenching behaviours were observed. The 0.01% Cr3+ is the optimum concentration.

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Yes

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PhD

Main supervisor (name and email)
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Session Classification: DPCMM1

Track Classification: Track A - Division for Physics of Condensed Matter and Materials