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## Effects of Cr<sup>3+</sup> mol% on the structure and optical properties of the ZnAl<sub>2</sub>O<sub>4</sub>:Cr<sup>3+</sup> nanocrystals synthesized using sol-gel process

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

**Abstract content** (Max 300 words) [http://events.saip.org.za/getFile.py/a?target=\\_blank](http://events.saip.org.za/getFile.py/a?target=_blank) **Formatting & Special chars**

Zinc aluminate (ZnAl<sub>2</sub>O<sub>4</sub>) hosts and ZnAl<sub>2</sub>O<sub>4</sub>:Cr<sup>3+</sup> doped were successfully prepared at a relatively low temperature (~80 °C) using the sol-gel method. The dopant (Cr<sup>3+</sup>) 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 ZnAl<sub>2</sub>O<sub>4</sub> structure. The estimated crystallites sizes were in the range of 22 – 23 nm in diameter. The results showed that there is an optimum Cr<sup>3+</sup> mol% for the system to deviate from Vegard's law. The surface morphology of the phosphors was influenced by the Cr<sup>3+</sup> mol%. UV results showed that the Cr<sup>3+</sup> mol% affects the band gap of the host. The PL results showed that the host and the Cr<sup>3+</sup>-doped nanoparticles exhibit violet emission slightly at different peak positions. Slight peak shifts suggests that the luminescence can originate from the host or Cr<sup>3+</sup> ion. Emission from the host is attributed to the band-gap defects in the host material, while the emission from the Cr<sup>3+</sup> is attributed to the 4T<sub>1</sub> → 4A<sub>2</sub> transition. At the higher mol% there is an emission at 692 nm, which is attributed to the 2E → 4A<sub>2</sub> transition in Cr<sup>3+</sup>. The incorporation of the foreign atoms (Cr<sup>3+</sup>) 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% Cr<sup>3+</sup> is the optimum concentration.

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

Yes

**Level for award (Hons, MSc, PhD)?**

PhD

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

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**Would you like to submit a short paper for the Conference Proceedings (Yes / No)?**

Yes

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