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Morphological and Luminescent properties of $\text{Y}_3(\text{AlGa})_5\text{O}_{12}:\text{Ce}^{3+}$ powder phosphor

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Abstract content
 (Max 300 words)

Cerium-doped yttrium aluminum garnet ($\text{Y}_3\text{Al}_5\text{O}_{12}:\text{Ce}^{3+}$ or YAG:Ce) is used in several applications such as solid state lighting and scintillators. The Ce^{3+} ion is responsible for a nanosecond decay time and an intense emission at a visible wavelength range. Most phosphors have been developed for the use in fluorescent tubes or compact fluorescent lamps that use UV radiation, and hence, they have not been optimized for the use in light emitting diodes (LEDs) that emit in the visible spectrum range. The first basic commercially available white LED is based on an InGaN chip emitting blue light at a wavelength of 460 nm that is coated with a YAG:Ce phosphor layer that converts some of the blue light into yellow light which is combined to give a rather cool white light. This is fine for many applications (e.g., displays and lighting in cars), but the quality of light is not good enough for home lighting, for which a warmer white light containing some red light is desirable. To get the red light in LEDs, in YAG:Ce, Al^{3+} is often replaced with Ga^{3+} to form $\text{Y}_3(\text{AlGa})_5\text{O}_{12}:\text{Ce}^{3+}$ due to the similarity in cation size. Knowing properties of this phosphor in detail could lead to the application of this phosphor in manufacturing of LEDs for home lighting. In this work the $\text{Y}_3(\text{AlGa})_5\text{O}_{12}:\text{Ce}^{3+}$ powder phosphor is characterized with different techniques. Scanning Electron Microscopy revealed the phosphor's agglomerated particles with a size ranging from 0.4μ to 1.4μ . X-ray diffraction data showed a polycrystalline structure with average crystal size of 80nm. Luminescent properties include the emission wavelength at 509nm which was also used to approximate the Al/Ga ratio within the crystal. Photoluminescence data also reveal that addition of Ga into the YAG:Ce matrix caused a blue-shift in the emission spectra. A full electron degradation study is also provided.

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MSc

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

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