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Blue luminescence from Bi doped MgAl₂O₄ prepared by the combustion method

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Abstract content
   (Max 300 words)

Magnesium aluminate (MgAl₂O₄) has received special attention as a technologically important material because of its attractive properties such as mechanical strength, chemical inertness, wide band gap, relatively low density, high melting point, high thermal shock resistance, low thermal expansion coefficient, resistance to neutron irradiation and low dielectric loss. It has also been considered as a phosphor host activated by a variety of transition metal and lanthanide ions. As an alternative to such ions, luminescence can often be obtained from the ns²-type ions such as Tl⁺, Pb²⁺, Bi³⁺ and Sb³⁺. For trivalent bismuth ions luminescence is attributed to electron transitions between the 6s² ground state and the 6s6p excited states. A simple combustion method was employed for the preparation of Bi doped MgAl₂O₄ nanocrystals using metal nitrates as precursors and urea as a fuel in a furnace preheated to 520˚C. The samples were characterized by x-ray diffraction, UV-Vis spectroscopy, scanning electron microscopy and photoluminescence spectroscopy. For an excitation wavelength of 330 nm, the Bi doped MgAl₂O₄ produced a blue emission band centred near 410 nm, indicating that Bi³⁺ ions were successfully incorporated in the lattice. The maximum emission intensity was obtained for the sample doped with 0.5 mol% Bi. The results indicate that doping MgAl₂O₄ with Bi ions may be an attractive alternative to doping it with Ce ions, which give broad blue-green luminescence in this host but requires reducing at a high temperature (1400˚C) to convert non-luminescent Ce⁴⁺ ions to the luminescent Ce³⁺ charge state.

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Yes

Level for award
 (Hons, MSc,
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PhD

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

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Yes

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