Contribution ID: **1506** Type: **Oral**

A comparative study of the effect of the sol-gel, combustion, and solid state reaction methods on the photoluminescence properties of the Zn4B6O13:Eu3+ nanophosphors.

Thursday 31 October 2024 12:45 (15 minutes)

The selection of synthesis methods significantly influences the properties of nanomaterials intended for use in solid-state lighting device applications. In our study, Zinc borate nanophosphors doped with 1 mol% europium (Zn4B6O13:Eu3+) were synthesized using various methods such as the sol-gel, combustion, and solid-state reaction methods. The impact of the various method on the structural and photoluminescence properties of the material is thoroughly investigated. The prepared zinc-borate nanophosphors were successfully annealed at 800 oC. XRD results confirmed a cubic crystal structure formation for all samples. All the synthesized Zn4B6O13:Eu3+ phosphor materials showed a 95% matching score with the JCPDS file (No. 01-076-0917) of the host material. There was a small discrepancy among the crystallite sizes of the nanophosphors, ranging from approximately 95 to 98 nm. The calculated crystallite sizes are very small relative to the literature. Various morphologies were observed through scanning electron microscopy (SEM); polyhedron-like, hexagonal-like, and irregular morphologies for sol-gel, combustion, and solid-state reaction methods, respectively. All samples were distinctly agglomerated into groups. The average particle sizes for the prepared nanophosphors ranged from 500 to 890 nm. Upon excitation at 248 nm while monitoring the highest emission peak at 615 nm, the photoluminescence emission trends were observed to be in this trend: sol-gel > solid state > combustion reaction methods. The highest emission peak was assigned to the europium electric dipole transition, namely: 5D6 ⟶ 7F2. The CIE chromacity diagram revealed a reddish colour emission for all the synthesized phosphor materials, which were (0.642, 0.353), (0.641, 0.352), and (0.644, 0.354) for sol-gel, combustion, and solid-sate reaction methods, respectively. The synthesized phosphor materials could be potential candidates for red light-emitting diodes (RLEDs) applications.
Keywords : Zn4B6O13:Eu3+, photoluminescence, synthesis method.

Primary author: SIYALO, Athenkosi (University of the Western Cape)

Co-authors: Prof. HALINDINTWALI, Sylvain (University of the Western Cape); Prof. REDDY, Leelakrishna (University of Johannesburg); Dr BALAKRISHNA, Avula (University of Johannesburg)

Presenter: SIYALO, Athenkosi (University of the Western Cape)

Session Classification: Condensed Matter Physics

Track Classification: Condensed Matter Physics