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Luminescent properties of $\text{Ca}_5(\text{PO}_4)_3\text{OH}:\text{Gd}^{3+}/\text{Pr}^{3+}$ phosphor powder

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Abstract content
 (Max 300 words)

Hydroxylapatite $\text{Ca}_5(\text{PO}_4)_3\text{OH}$ is a well-known bioceramic material for medical application. It is biocompatible meaning that it has the ability to form chemical bonds with living tissues. Recently, it has, however, been used as host for rare or alkaline earth ions to prepared light emitting materials or phosphors. Phosphate based inorganic compounds doped with rare earth ions form an important family of phosphors for solid state lighting applications [1]. Calcium phosphate powders have been synthesized by co-precipitation method. In this study, we prepared (using co-precipitation method) and investigated the structure, morphology, photoluminescent and thermoluminescent properties of $\text{Ca}_5(\text{PO}_4)_3\text{OH}:\text{Gd}^{3+}/\text{Pr}^{3+}$ co-doped with gadolinium (Gd^{3+}) and praseodymium (Pr^{3+}). The X-ray diffraction (XRD) patterns show a single hexagonal phase of $\text{Ca}_5(\text{PO}_4)_3\text{OH}$ consistent with standard JCPDS data file No 73-0293. The XRD peaks were sharp and intense suggesting that the phosphor was highly crystalline. The scanning electron microscopic images show that the powders consist of an agglomeration of spherical particles. The $\text{Ca}_5(\text{PO}_4)_3\text{OH}:\text{Gd}^{3+}/\text{Pr}^{3+}$ phosphor exhibit a narrow emission peak at 313 nm due to the ${}^6\text{P}_{7/2} \rightarrow {}^6\text{P}_{5/2}$ transition of the Gd^{3+} ion, and the emission was sensitized by Pr^{3+} co-doping. The TL glow shows the single glow peak at 346 K. The single peak suggests that there is only one type of electron trap in the forbidden band of the material, and the trap may be due to the defects such as vacancies or impurities in the material. The luminescent properties of the $\text{Ca}_5(\text{PO}_4)_3\text{OH}:\text{Gd}^{3+}/\text{Pr}^{3+}$ phosphor are evaluated for application of the phosphor in solid-state lighting.

References

[1] K N Shinde, S J Dhoble, Advanced Material letters, 2010, 1(3), 254-258

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