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Superstructures of doped yttrium aluminates for luminescent and advanced forensic investigations

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Abstract

Nanocrystalline Tb^{3+} (1–11mol %) doped $YAlO_3$ phosphors were prepared by biocompatible combustion route using *Aloe Vera* gel as a fuel. The average crystallite sizes were estimated using XRD and TEM found to be ~27 nm. Scanning electron micrographs showed mcirolayered superstructurs of various shapes of uniform particles. Upon 341 nm excitation, the photoemission profile of $YAlO_3$: Tb^{3+} exhibit a narrow green emission peak at 545 nm due to $^5D_4 \rightarrow {}^7F_5$ transition. Optical parameters such as Judd–Ofelt parameters, radiative transition probabilities, radiative lifetimes, branching ratio, stimulated emission cross-section and optical gain were estimated by Judd–Ofelt theory. CIE coordinate for the optimized phosphor was (x=0.308, y=0.435) which is very close to NTSC standard value for green emission. Further, the correlated color temperature was estimated and found to be ~ 6178 K. A simple, fast, highly sensitive and ecofriendly method for the detection and enhancement of fingermarks in various forensic relevant materials was presented.

KEYWORDS: Bio mediated synthesis; Morphology; Photoluminescence; Judd-Ofelt analysis; latent fingerprint.

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