Novel and highly efficient red luminescent sensor based SiO2@ Y2O3: Eu3+, M+ (M+= Li, Na, K) composite core–shell fluorescent markers for latent fingerprint recognition

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Abstract

Facile solution combustion route was used to prepare the optimized composite core shell SiO_2@Y_2O_3:Eu^{3+}, Li^+ fluorescent nanopowders (NPs) with superior fluorescence intensity under UV light. Powder dusting technique was used for the visualization of latent fingerprints (LFPs) on different porous and non-porous surfaces. The results display that the amorphous SiO_2 microspheres were covered by crystalline Y_2O_3:Eu^{3+}, Li^+ NPs, resulting in spherical core-shell structure. The phosphors exhibit intense pure strong red emission corresponding to characteristic Eu^{3+} ions $^5D_0 \rightarrow {}^7F_2$ transitions under NUV excitation. The CIE co-ordinates were found to be (x = 0.63, y = 0.36) which is very close to standard NTSC values (x = 0.67, y = 0.33). Judd-Ofelt theory was used to estimate the intensity parameters (Ω_2 and Ω_4) as well as radiative properties. The CCT value was ~ 3475 K which was less than 5000 K, as a result the phosphor was highly useful in warm light emitting diodes. Thus, results presented confirms that the developed method was simple, fast and optimized phosphor was effectively used for multifunctional applications namely luminescent sensor for visualization of LFPs, solid state lightning and security ink applications.