Rational design of monovalent ions (Li, Na, K) co-doped $ZnAl_2O_4$: Eu^{3+} nanocrystals enabling versatile robust latent fingerprint visualization

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Abstract:

Alkali metal ions (M^+ = Na, Li, K) co-doped $ZnAl_2O_4$: Eu^{3+} (5 mol %) (ZAE) nanopowders (NPs) were prepared via solution combustion route using *mimosa pudica* (*MP*) leaves extract as a fuel. PXRD results of co-doped samples enhance the crystallinity and grain growth. Photoluminescence (PL) of the prepared ZAE and ZAE: M^+ (M^+ = Na, Li, K) NPs showed intense emission peaks in the range 550 – 750 nm and ascribed to $^5D_0 \rightarrow {}^7F_J$ (J = 0 - 4) transitions of Eu^{3+} ions respectively. A 2-fold enhancement in PL intensity was observed in Li^+ co-doped samples. The optimized $ZnAl_2O_4$: Eu^{3+} (5 mol %), Li^+ (1 wt %) (ZAEL) NPs are used to visualize LFPs on various porous, semi-porous and non-porous surfaces through robust powder dusting technique. The visualized latent fingerprints (LFPs) revealed well defined level 1-3 ridge characteristics under several tests such as fingerprint aging and fresh water treatment for various time durations. The obtained results clearly evident that the prepared NPs were quite useful for multifunctional applications such as, advanced forensic and solid state lightning.

Keywords;

Photoluminescence; Latent fingerprints; Solid state lightning; Alkali metal ions