Indian Journal of Chemistry
Vol. 63, June 2024, pp. 604-612
DOI: 10.56042/ijc.v63i6.9533

Harnessing the polarizability of capping ligands for enhancing the intensity of hypersensitive electric dipole transition in Eu^{3+} doped CaF_2 nanoparticles

Ngasepam Bhogenjit Singh & Thiyam David Singh*
Department of Chemistry, National Institute of Technology Manipur, Langol 795 004, India
E-mail: davidthiyam@yahoo.co.in

Received 13 March 2024; accepted (revised) 25 April 2024

The enhancement of intensity of the hypersensitive $^5D_0 \rightarrow {}^7F_2$ transition in Eu^{3+} doped CaF_2 nanoparticles (NPs) by exploitation of polarizability of the stabilizing ligands (ethylene glycol (EG), citrate (TSC) and EDTA) is reported. The correlation between the asymmetric ratio, R $\{I(^5D_0 \rightarrow {}^7F_2)/I(^5D_0 \rightarrow {}^7F_1)\}$ of the transition with the nature of the capping ligands is studied by determining Judd-Ofelt intensity parameter (Ω_2), radiative transition probability (A) and average lifetime (τ). R is maximum for EDTA capped NPs followed by TSC and EG capped NPs. Bi-exponential fitting of the decay curves indicate the contribution of Eu^{3+} in the grain boundary to the R value is maximum for EDTA stabilized NPs. Cytotoxicity studies on epithelial human breast cancer cell (MDA 231) and RAW 264.7 cells suggested biocompatibility of 75% up to a maximum concentration 250 µg/mL. These characteristics demonstrate the potential of employing these synthesized nanoparticles in the fields of optical devices, as well as in bioimaging.

Keywords: Calcium fluoride nanoparticles, Hypersensitive transition, Intensity enhancement, Stabilizing ligands, Biocompatibility