

The Effect of Chelate to RE Ratio on Upconversion Emissions Property of NaYF₄: Yb³⁺ and Tm³⁺ Nanocrystals

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Abstract : In this paper the NaYF₄: Yb³⁺, Tm³⁺ nanocrystals were synthesized by hydrothermal method. Different chelating ligand type (citric acid, butanoic acid, and AOT) was selected to investigate the effect of their concentration on upconversion efficiency. Crystal structure and morphology have been well characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM) and transmission electron microscopy (TEM) analysis. Photo luminescence were recorded on a spectrophotometer equipped with 980 nm laser diode as excitation source and an integrating sphere. The products with various morphologies range from sphere to cubic, hexagonal, prism and nanorods were prepared at different ratios. The particle size was found to be dependent on the nucleation rate, which, in turn, was affected by type and concentration of ligands. The optimum amount of chelate to RE ratio was obtained 0.75, 1.5, and 1 for Citric Acid, Butanoic Acid and AOT, respectively. Emissions in the UV (1D2-3H6), blue-violet(1D2-3F4), blue (1G4-3H6), red (1G4-3F4), and NIR (1G4-3H5) were observed and were the direct result of subsequent transfers of energy from the Yb³⁺ ion to the Tm³⁺ ion.

Keywords : upconversion nanoparticles, NaYF₄, lanthanide, hydrothermal

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