

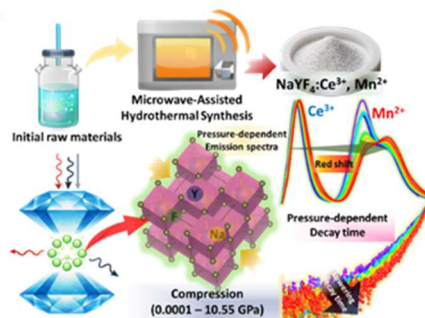
Pressure-Induced Changes in the Luminescence properties of NaYF₄:Ce³⁺, Mn²⁺ Phosphors

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Novel optical sensor, Ce³⁺, Mn²⁺ co-doped NaYF₄ polycrystalline phosphor material was developed by microwave assisted hydrothermal synthesis method. Single phase of crystal structure of synthesized material was confirmed by X-ray diffractometry and found that it crystallize in cubic crystal structure of the Fm $\bar{3}$ m space group. The morphology and distribution of the parent elements were analyzed by SEM coupled with EDX analysis. The emission spectra show two emission bands at 333 (Ce³⁺, ⁵d₁ → ⁴f₁) and 560 nm (Mn²⁺, ⁴T₁(G) → ⁶A₁(6S)) when excited at 270 nm. High pressure luminescence studies of the synthesized materials were carried out using diamond anvil cell for multi-mode optical pressure sensor applications. The pressure-dependent spectral shift of both bands at 333 and 560 nm show linear tendency with rate (dλ/dP) of 1.05 and 2.67 nm GPa⁻¹ respectively. The rate (dτ/dP) of change of decay time with pressure for the band at 560 nm was found to be 1.10 ms GPa⁻¹. The as synthesized phosphor material exhibit significant color tuning behavior varying from red to yellow region in the CIE chromaticity diagram with respect to increasing pressure. The absolute sensitivity of both the x and y coordinates were calculated to be 1.7 and 3.7 GPa⁻¹. Considering the multimode parametric values, the as obtained novel phosphor (NaYF₄:Ce³⁺, Mn²⁺) material can be utilized as potential optical pressure sensor in the pressure range from ambient pressure to 10.55 GPa.



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