

Reduction effects on divalent and trivalent europium ions in CaF₂ nano particles investigated by optical and luminescence spectroscopy

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The europium ions (1mol %) doped in CaF₂ nano particles were prepared by thermal-decomposition method at 350°C for 2hrs. Trivalent europium ions in CaF₂ nano powders were reduced by thermal carbon reducing atmosphere (TCRA) at different temperature. We investigate the reduction effects by laser excitation spectroscopy. The laser excitations were performed by third harmonic 355 nm pulsed Nd:YAG laser dye laser pumped by second harmonic 532 nm laser. The emission spectra of europium ions show that there exist divalent and trivalent europium ions. The broad divalent europium emission has a peak at around 421 nm and zero-phonon line are observed at 412.9 nm at low temperature. This is interesting result because it is known that no zero-phonon line is observed in usual europium doped nano materials because of the size effects. The emission lines of the trivalent europium ions are clearly observed at 573, 577.5, 581, 617, and 631 nm and exhibit different temporal behavior in the temperature range 14 K - room temperature. The intensity ratio between divalent europium ions and trivalent europium ions are changed by TCRA temperature. In this presentation, we discuss the laser spectroscopic results in relation to the sample preparation conditions.