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Photoluminescence, Thermoluminescence glow curve and emission characteristics of Y₂O₃:Er³⁺ nanophosphor

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Abstract

Nanocrystalline Er^{3+} doped Y₂O₃crystals were prepared by a sol gel technique. X-ray diffraction (XRD) patterns showed the cubic structure of Y₂O₃ and the crystallite size was found to be ~25 nm. Optical absorption showed absorption peaks at 454, 495 and 521 nm. These peaks are attributed to the ${}^{4}F_{3/2} + {}^{4}F_{5/2}$, ${}^{4}F_{7/2}$ and ${}^{2}H_{11/2} + {}^{4}S_{3/2}$ transitions of Er^{3+} . Under excitation at 378 nm, the appearance of strong green (520-565 nm) down conversion emission assigned to the (${}^{2}H_{11/2}$, ${}^{4}S_{3/2}$) $\rightarrow {}^{4}I_{15/2}$ transition and the feeble red (650-665 nm) emission is assigned to the ${}^{4}F_{9/2} \rightarrow {}^{4}I_{15/2}$ transition. The color chromaticity coordinates showed emission in the green region. The strong green emission of Y₂O₃: Er^{3+} nanophosphor may be useful for applications in solid compact laser devices. Thermoluminescence (TL) studies of γ -irradiated Y₂O₃: Er^{3+} showed a prominent TL glow peak maximum at 383 K along with a less intense shoulder peak at ~425 K and a weak glow at 598 K. TL emission peaks with maxima at 545, 490, 588 and 622 nm for the doped sample were observed at a temperature of 383 K and these emissions were due to defect related to the host material. TL kinetic parameters were calculated by a glow curve deconvolution (GCD) method and the obtained results are discussed in detail for their possible usage in high dose dosimetry.

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