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# Concentration-dependent visible photoluminescence of $\text{In}_2\text{O}_3$ : $\text{Er}^{3+}$ under 532 nm excitation

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## Abstract

$\text{In}_2\text{O}_3$  thin films were doped with  $\text{Er}^{3+}$  at different concentrations (0.5 - 2%) by sol-gel method and annealed at 1000 °C. The  $\text{In}_2\text{O}_3$ :  $\text{Er}^{3+}$  films were characterized by X-ray diffraction, atomic force microscopy, scanning electron microscopy, X-ray photoelectron spectroscopy, photoluminescence (PL) and ellipsometry. The films are polycrystalline with a cubic structure related to  $\text{In}_2\text{O}_3$ . The trivalent state of Erbium in the  $\text{In}_2\text{O}_3$  crystal is confirmed by photo electron spectroscopy. Doped films were excited under selective  $\text{Er}^{3+}$  excitation at 532 nm; the visible  $\text{Er}^{3+}$ -related emission is observed in the photoluminescence spectra and the major emissions occur in the green region with strongest lines at 548 and 567 nm. They are mainly produced by the Stark split  $^2\text{H}_{11/2}$  and  $^4\text{S}_{3/2}$  transitions to  $^4\text{I}_{15/2}$  ground state and highest emission is observed on  $\text{In}_2\text{O}_3$ : 1%  $\text{Er}^{3+}$ .

**Keywords:**  $\text{In}_2\text{O}_3$  thin films; Sol-Gel; Rare earth; Photoluminescence;  $\text{Er}^{3+}$ -related emission; Structural properties.

## 1. Introduction

$\text{In}_2\text{O}_3$  thin films has attracted a great interest as wide band gap semiconductor (~ 3.7 eV) because of the high optical transmission in the visible region (> 80%) [1]. Therefore,  $\text{In}_2\text{O}_3$  can be used in many fields such as solar cells, light emitting diodes, memory storage devices

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