

# Structural modification, photoluminescence, and magnetic property enhancement with Er<sup>3+</sup> doping, of sol–gel TiO<sub>2</sub> thin films

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**Abstract:** Nanocrystalline undoped and Er<sup>3+</sup> doped TiO<sub>2</sub> thin films were prepared by sol–gel dip-coating technique onto glass substrates. Post-deposited films were annealed at 450 °C for 1 h. Differential scanning calorimetric analysis showed that undoped film crystallization occurred at 339 °C, while it appears at lower temperature for Er:TiO<sub>2</sub>. X-ray diffraction and Raman spectroscopy results indicate that the films crystallize only into anatase phase, and the crystallite size decreases from 24.3 to 21.16 nm with increasing Er<sup>3+</sup> doping ratio. The photoluminescence (PL) spectra are composed of two broad peaks at 520–570 nm and 640–680 nm assigned to (<sup>2</sup>H<sub>11/2</sub>, <sup>4</sup>S<sub>3/2</sub>)–<sup>4</sup>I<sub>15/2</sub> and <sup>4</sup>F<sub>9/2</sub>–<sup>4</sup>I<sub>15/2</sub> transitions of Er<sup>3+</sup> ions, respectively. PL emission intensities increase gradually raising the erbium doping ratio. Vibrating sample magnetometer results of undoped TiO<sub>2</sub> thin films reveal a ferromagnetic behavior at room temperature and erbium doping leads to an enhancement of the saturated magnetic moment (M<sub>s</sub>).

**Keywords :** TiO<sub>2</sub> doped Er<sup>3+</sup>, Sol–gel, Photoluminescence, Magnetic Properties