Structural modification, photoluminescence, andmagnetic property enhancement with Er³⁺ doping,of sol–gel TiO₂ thin films

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Abstract: Nanocrystalline undoped and Er^{3+} doped TiO₂ thin films were prepared by sol–gel dip-coatingtechnique onto glass substrates. Post-deposited films were annealed at 450 °C for 1 h. Differentialscanning calorimetric analysis showed that undoped film crystallization occurred at 339 °C, while appears at lower temperature for Er:TiO₂. 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^{3+} doping ratio. The photoluminescence (PL) spectra arecomposed of two broad peaks at 520–570 nm and 640–680 nm assigned to ($^{2}\text{H11/2}$, $^{4}\text{S}_{3/2}$)⁻⁴I_{15/2} and $^{4}\text{F}_{9/2}$ – $^{4}\text{I1}_{5/2}$ transitions of Er^{3+} ions, respectively. PL emission intensities increase gradually raising the erbium doping ratio. Vibrating sample magnetometer results of undoped TiO2 thin films reveala ferromagnetic behavior at room temperature and erbium doping leads to an enhancement of thesaturated magnetic moment (M_s).

Keywords : TiO2 doped Er3+, Sol-gel, Photoluminescence, Magnetic Properties