

# Structural modification and magnetic properties enhancement with $\text{Er}^{3+}$ , of sol-gel $\text{TiO}_2$ thin films

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## Abstract

Nanocrystalline undoped and erbium doped  $\text{TiO}_2$  thin films were dip-coated on glass substrates by sol-gel method. The films were annealed at 450 °C during 1 hour. DSC results show that the crystallization effectuates at 339°C for undoped  $\text{TiO}_2$ , whereas for erbium doped  $\text{TiO}_2$  the crystallization occurs earlier with two separated exothermic. XRD diagrams illustrate that undoped and erbium doped  $\text{TiO}_2$  crystallize in anatase phase only and indicate that the crystallite size decreases from 24.06 to 21.19 nm as a function of the increase in  $\text{Er}^{3+}$  content. This result is confirmed by Raman spectra. Moreover, the VSM results indicate, on one hand, a ferromagnetic behavior of the undoped  $\text{TiO}_2$ . On the other hand, the incorporation of Erbium leads to an enhancement of the ferromagnetic behavior. It is worthy to mention that the weak  $\text{Er}^{3+}$  doping (0.1 at.%) is the high ordered magnetically with highest saturation magnetization of 1.92 memu. Both elaborated  $\text{TiO}_2$  and  $\text{Er}:\text{TiO}_2$  films show good structural properties and have a diluted magnetic semiconductors structure. The films are promising for the possible applications in optoelectronic devices.

**Keywords:**  $\text{TiO}_2$  doped  $\text{Er}^{3+}$  ; structural properties; sol-gel; magnetic properties; oxygen vacancies.