

# STRUCTURAL, THERMAL AND OPTICAL CHARACTERIZATION OF TiO<sub>2</sub>:ZrO<sub>2</sub> THIN FILMS PREPARED BY SOL–GEL METHOD

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## Abstract

We have studied the structural and optical properties of thin films of TiO<sub>2</sub>, doped with 5% ZrO<sub>2</sub> and deposited on glass substrate (by the sol–gel method). The dip-coated thin films have been examined at different annealing temperatures (350 to 450 °C) and for various layer thicknesses (63–286 nm). Refractive index and porosity were calculated from the measured transmittance spectrum. The values of the index of refraction are in the range of 1.62–2.29 and the porosity is in the range of 0.21–0.70. The coefficient of transmission varies from 50 to 90%. In the case of the powder of TiO<sub>2</sub>, doped with 5% ZrO<sub>2</sub>, and aged for 3 months in ambient temperature, we have noticed the formation of the anatase phase (tetragonal structure with 14.8 nm grains). However, the un-doped TiO<sub>2</sub> exhibits an amorphous phase. After heat treatments of thin films, titanium oxide starts to crystallize at the annealing temperature 350 °C. The obtained structures are anatase and brookite. The calculated grain size, depending on the annealing temperature and the layer thickness, is in the range (8.58–20.56 nm).

**Keywords:** Thin films, TiO<sub>2</sub>–ZrO<sub>2</sub>, Sol–gel, Anatase, Brookite, Optical properties Structural properties, Thermal properties.