

Correlation between structural and optical properties of $\text{TiO}_2:\text{ZnO}$ thin films prepared by sol-gel method

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Abstract: We have studied structural and optical properties of thin films of TiO_2 , doped with 5% ZnO and deposited on glass substrate (by the sol-gel method). Dip-coated thin films have been examined at different annealing temperatures (350–450 °C) and for various layer thicknesses (89–289 nm). Refractive index, porosity and energy band gap were calculated from the measured transmittance spectrum. The values of the index of refraction are in the range of 1.97–2.44, the porosity is in the range of 0.07–0.46 and the energy band gap is in the range of 3.32–3.43. The coefficient of transmission varies from 50 to 90%. In the case of the powder of TiO_2 , doped with 5% ZnO , and aged for 3 months in ambient temperature, we have noticed the formation of the anatase phase (tetragonal structure with 20.23 nm grains). However, the un-doped TiO_2 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 of 8.61–29.48 nm.

Keywords : Thin films, $\text{TiO}_2\text{-ZnO}$, Sol-gel, anatase, Brookite, optical properties, Structural properties, Thermal Properties