

Investigation of Thermal and Optical Properties of Thin WO₃ Films by the Photothermal Deflection Technique (PTD)

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Owing to its novel physical properties, as well as its technological implication in many fields, the thermal and optical properties of WO₃ thin films are studied here. These thin films are prepared from ammonium tungstate and deposited on a glass substrate at 400°C by the spray pyrolysis technique. The thermal properties (thermal conductivity and thermal diffusivity) were studied by the photothermal deflection method in a uniform heating mode instead of the traditional non uniform heating one by comparing the experimental amplitude and phase variations versus square root modulation frequency to the corresponding theoretical ones. The best agreement between theory and experiment is obtained for well-defined values of thermal conductivity and thermal diffusivity. The optical properties (optical absorption spectrum and gap energy) were measured using the photothermal deflection spectroscopy (PDS) by drawing the experimental amplitude and phase variation versus wavelength and versus the theoretical absorption coefficient at a fixed modulation frequency. By comparing point by point the normalised experimental and corresponding theoretical amplitude variation, one can deduce the optical absorption spectrum. Using the Tauc law for energies above the gap we can deduce the gap energy. We notice that these films show low thermal conductivity and high transparency in the visible range.