



OPTICAL AND STRUCTURAL PROPERTIES OF TiO₂ THIN FILMS BY CHEMICAL SPRAY PYROLYSIS

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ABSTRACT

TiO₂ thin films prepared by spray pyrolysis have attracted so many interests due to its versatility and cost effectiveness. TiO₂ thin films have different applications such as electrodes in solar cells, photocatalyst and gas sensor devices. The aim of this study was to determine the structural and optical properties of the sprayed TiO₂ thin films as the function of the substrate and annealing temperature. In the present work TiO₂ thin films were deposited onto cleaned glass and silicon(100) substrates using chemical spray pyrolysis technique. The spray solution containing titanium (IV)isopropoxide, acetylacetone and ethanol were sprayed at substrates temperature between 260°C to 500°C. The thin films were deposited at a spray rate of 3ml/minute by employing 2 spray pulses (60 seconds spray and 60 seconds pause). The resulting TiO₂ films were later annealed at 500°C. The TiO₂ films were characterized by FTIR, XRD and UV-VIS measurements. According to XRD and FTIR analysis, as-deposited TiO₂ films grown below 500°C are amorphous and consist of the organic residues. Crystalline TiO₂ films with anatase structure could be obtained by deposition at 500°C or by post-deposition annealing at 500°C and above. Film thickness, refractive index and optical band gap values were calculated from transmittance spectra recorded by UV-VIS spectrophotometer. According to UV-VIS, TiO₂ film thickness increases with the substrate temperature from 70 to 150 nm. Crystalline TiO₂ films with anatase structure exhibit refractive indices between 2.0 and 2.3 nm and optical band gap value ca 3.2 eV.

Keywords: TiO₂, chemical spray pyrolysis, structural properties, optical properties, annealing