Optical and microstructural characterization of thick TiO_2 layers produced using magnetron sputtering technique

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Optical and microstructural properties of materials synthesized using magnetron sputtering technique strongly depend on the growth conditions (i.e. temperature of substrate, pressure of inert and reactive gases, bias voltage).

The thick (a few hundred of nm) titanium dioxide layers were synthesized applying two techniques: pulsed magnetron sputtering and, lately developed, gas injection magnetron sputtering at variable argon/oxygen plasma composition. The two deposition methods have allowed the production of coatings in two completely different gas conditions in the vacuum chamber.

Optical and microstructural properties of the produced TiO_2 films were investigated using spectroscopic ellipsometry (V-VASE, J.A.Woollam Co., Inc.) and scanning electron microscopy (ZEISS Ultra Plus). To extract optical constants of the thick titanium dioxide layers different optical models of samples (with different complexity) were prepared. These models allowed to estimate the average values of optical constants of TiO_2 layers of as well as to perform detailed analysis of variable optical constants of TiO_2 through the axis perpendicular to the substrate. These results are confirmed by SEM measurements (cross-sections of TiO_2 layers).

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