

Poster MS1

Structural and Optical Properties of Sol-Gel Thin Films for Photovoltaic Applications

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Due to its large band gap, high transparency in the visible region spectrum, high refractive index, high chemical and mechanical stability, TiO₂ has a large variety of potential applications as ceramic membrane antireflective coating in solar cells. Among the various processes for the elaboration of TiO₂ thin films, sol-gel method presents many advantages especially in its simplicity: low deposition temperature, high homogeneity and purity for the elaborated materials and large coated surfaces can be achieved. Our research in this paper were focused on the influence of the sol concentration on the structural and optical properties of dip-coated TiO₂ thin films on glass substrates for photovoltaic applications. By sol-gel process, two types of TiO₂ thin films were dip-coated on microscopic glass substrates according to the concentration of the solvent (2-propanol) in the sol. The samples treated were characterized by XRD, spectrophotometry, ellipsometry and AFM microscopy in order to observe the influence of the solvent concentration on their structural and optical properties.

The effect of sol concentration was studied. The structural properties were found to be strongly influenced by the amount of the solvent in the sol. A mixture of anatase and rutile structure was found for the films derived from low concentrated sol and an only anatase structure for films derived from high concentrated sol.

The AFM observations have shown a uniform topography, porous structure and low roughness for the films prepared by sol with low concentration. The estimated refractive index dispersions were found to be invariant with the number of the coating but increase by increasing sol concentration indicating a dense structure which is in good agreement with AFM observations. The transparency of the films increases with the solvent content. A transmittance above 88% was reached all over the visible spectrum which makes this sol-gel elaborated oxide a good material for photovoltaic applications. TiO₂ sol-gel thin films were successfully dip-coated on glass substrates. From this study, TiO₂ elaborated presents the best optical and structural properties for photovoltaic applications as an antireflective coating.

Keywords

Thin films coating, sol-gel, optical properties.