

The effect of copper nano-cluster as sublayer on optical and crystalline properties of titanium dioxide layers

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Abstract: Two 10 and 20nm samples of Cu nano-cluster were grown on quartz substrates with a thickness of by electron beam deposition method. Nanolayers of titanium dioxide with a thickness of 300 nm were deposited on these Cu nano-cluster layers. For comparison, a layer of titanium dioxide with a thickness of 300 nm was also coated on quartz substrate. All coatings were conducted using electron-beam physical vapor deposition. The effect of Cu nano-cluster thickness on the surface morphology, grain size, grain boundaries, crystalline structure and phases, and optical properties of titanium dioxide layers were studied. The Field Emission Scanning Electron Microscope (FESEM) was used to analyze the surface morphology of prepared layers. Moreover, the crystalline structure of layers and phase transitions on heat treatment were studied using X-Ray Diffraction (XRD). The UV-Visible spectroscopy was used to analyze of the absorption and transmission spectra of titanium dioxide layers. Presence of Cu nano-cluster layers as sublayer increases surface roughness of the obtained TiO₂ layers and facilitates the phase transformation TiO₂ from anatase to rutile. Furthermore, presence of Cu nano-cluster sublayer decreases TiO₂ band gap energy for visible light absorption.

Keywords: *Copper nano-clusters; titanium dioxide; absorption; transmission; band gap.*

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