Thin and Thick Films of TiO2 by RF Inductive Plasmas Sputtering

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Abstract

The anatase and rutile phases are of great environmental and health interest. In the case of the first one, it is studied for atmospheric pollutants abatement and bacterial deactivation effects by its photocatalytic properties. Meanwhile, the second is investigated for production of biomaterials required by prosthesis and implants. Implantation-diffusion processes on titanium commercially pure target promoted in argon/oxygen (70%/30%) plasma permit to obtain only rutile phase when temperature target exceeds 500 ∘C. Simultaneously, thin and thick films of anatase and rutile phases on silicon and glass substrates have been obtained. This effect is due to the titanium sputtering process and the subsequent titanium oxidation. The plasma reactor consists in a cylindrical pyrex-like glass vessel inductively coupled to a 13.56 MHz RF generator. The power used in the experimentation was 500 W at 5×10-2 mbar working gas pressure along _˜5 hours. For the sputtering process, the target was negatively biased to 2000 V and 10 mA of direct current, the substrates electrically floated were placed at 2 cm away from the target. So, the temperature of the titanium target measured by a commercial K-type thermocouple was increased from 290 ∘C (plasma alone) to 680 ∘C when it was biased. Floated silicon and glass substrates measured temperature range was from 290 ∘C to 390 ∘C. With these conditions, up to 2.8 μm films were grown in the substrates. Films thickness were measured by profilometry, the crystallinity of phases was conducted by means of X-ray diffraction and Raman spectroscopy, the surface morphology and titanium/oxygen atomic percentages on target and glass/silicon films were characterized by scanning electron microscopy and X-ray photoelectron spectroscopy giving a ratio of TiO2 stoichiometry.

Keywords: TiO2, sputtering, RF plasma.

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