



11<sup>th</sup> International Conference  
on Advanced Materials

Rio de Janeiro Brazil  
September 20 - 25

## Selective optical TiN<sub>(x)</sub> compounds obtained by RF magnetron sputtering

K. Grigorov<sup>\*1,2</sup>, C.A.Cunha<sup>1</sup>, I.Oliveira<sup>1</sup>, J.Amorim,<sup>1</sup> M. Massi<sup>1</sup>, H.S. Maciel<sup>1</sup>

<sup>1</sup>Plasmas and Processes Laboratory – Department of Physics, Technological Institute of Aeronautics, 12228-900, S.J. Campos, Brazil

<sup>2</sup>Institute of Electronics, Bulgarian Academy of Science, 72 Tzarigradsko Chaussee, Sofia 1784, Bulgaria

### Abstract

An ideal optical coating has to possess both high absorption in the UV, visible and near IR regions (where more than 95% of the solar energy is emitted) and high reflectance in the thermal IR region. TiN belongs to a series of the transition metal compounds that has an unusual set of properties, envisaging photothermal solar energy conversion applications. Furthermore, TiN possesses high mechanical and chemical stability, excellent adhesion and very smooth surface resistance to scratches, properties which are of importance for any coating. All these properties are substantially determined, in general, by the composition, crystalline structure and microstructure of the material and consequently they are strongly dependent on the process and condition of preparation.

High quality crystalline TiN<sub>(x)</sub> thin films were deposited onto quartz substrates by RF magnetron sputtering varying the nitrogen partial pressure. The other deposition parameters, such as RF power, target-substrate distance and substrate temperature (400°C) were kept constant during the experiment. The film thicknesses and composition were checked by RBS and NRA (at 3.8 MeV). The optical spectra selectivity was estimated at the wavelength of 334 nm and in the near-IR region, whereas the surface morphology, namely the RMS roughness and the grain size diameter distribution was measured by AFM.

Both RBS and NRA results indicate that the film thicknesses are about 200 nm and they are free of contaminants. The phase composition  $x$  varies from 0.8 up to 1.5 which considerably influences their optical behaviors. The UV ( $\lambda = 3342.8\text{\AA}$ ) transmittance increases twice when the stoichiometry of the films overcomes 1.2, which could be of an importance for numerous applications. These optical behaviors are discussed in regard of the phase composition and microstructure of the films and related with the ratio gas-flow density to the flow density of the metal atoms.

---

\* Mailing address: [kgrigiro@abv.bg](mailto:kgrigiro@abv.bg)

The CAPES support is highly acknowledged