Photoluminescence spectra of TiN thin films

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Titanium nitride (TiN) is widely applied due to its good combination of physical-chemical properties: low specific resistance, relatively high transmittance within the visible spectral range, high hardness, high chemical and corrosion resistance [1,2].

Due to its physical properties TiN is a prospective material for the application in different photoelectrical devices. This work reports the results of a photoluminescence study of TiN thin films, prepared by the reactive magnetron sputtering method.

The deposition of the TiN thin films was carried out onto glass substrates by means of the reactive magnetron sputtering of a pure titanium target in the mixture of argon and nitrogen gasses at DC voltage. The partial pressures of argon and nitrogen were equal to 0.35 Pa and 0.7 Pa, respectively, at a constant magnetron power 120 W. The substrate temperature was equal to 573 K during the deposition process.

Photoluminescence spectra were measured using a diffraction monochromator MDR-23 and the signal from the photomultiplier was recorded using a standard synchronous detection system. Photoluminescence was excited by a nitrogen laser LGN-21 with $\lambda \approx 0{,}337$ μm. The obtained spectra were plotted basing on the hardware installer tool in coordinates: N_ω - number of photons within a single energy interval of quanta vs. radiation energy $h\nu$.

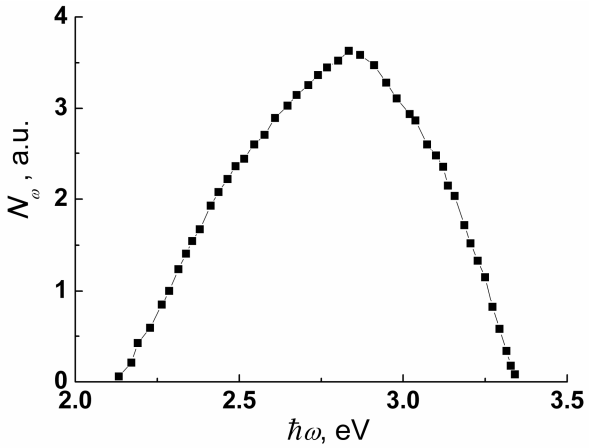

Fig.1. Photoluminescence spectra of TiN thin films, measured at 300 K

These TiN films possess a weak luminescence. Its range covers a wide region $h\nu \approx 2{,}1 \div 3{,}4$ eV at 300 K (Fig. 1). The maximum is located at $h\nu \approx 2{,}85$ eV which is possibly linked with the recombination processes via simple donor states and their associates. These centers are formed by redundant electrons (not involved in covalent chemical bonds) of titanium and intrinsic point defects charged vacancies of nitrogen and oxygen (background impurity).

[1] Y.L. Jeyachandran, Sa.K. Narayandass and D. Mangalaraj. *Materials Science and Engineering* **A 445–446**, 223 (2007).

[2] G. Gagnon, J.F.Currie, C. Beique, J.L. Brebner, L. Gujrathi and S.G. Onllet. *J. Appl. Phys.* **75,** 1565 (1994).