P-49

Simulation of the emitter existence conditions during cathode arc deposition of refractory materials

V.D. Alimov[1], A.V. Nedolya[1]* and I.N. Titov[2]

[1]*Zaporizhzhya National University, Applied Physics Department, 66 Zhukovsky Str., 69600 Zaporizhzhya, Ukraine*
[2]*STC PAS NAS Ukraine, 1 Chubanova Str., 69600 Zaporizhzhya, Ukraine*

Keywords: refractory, vacuum-arc, ecton, warm-up time.

*e-mail: nedolya@znu.edu.ua

The vacuum cathode arc deposition technology offer an excellent approach to production pure metal, alloy and compound at very high rates and with excellent adhesion and density. This allows efficient use of the method for applying coatings to accelerator technology [1]. However, there are problems with the choice of process parameters which will form a uniform film without dropping faction [2]. Therefore, the use of modeling processes of the formation of the plasma is an urgent problem.

Significantly upgrading one-dimensional mathematical model [3], which took into account the dependence of the heat capacity and thermal conductivity on temperature [4], the finite element method calculated the temperature distribution along the height of the emitter at different values in vacuum-arc deposition of zirconium, titanium and titanium nitride on the substrate.

Calculated minimum temperature explosion ecton and his warm-up time before the explosion at the characteristic of the current density ($1{,}2\cdot10^{12}$ A/m^2), which makes up for titanium nitride t = 9.86 ns at T = 6136 K, for titanium t = 9.48 ns at T = 7002 K, for zirconium t = 9.04 ns at T = 8336 K (fig. 1).

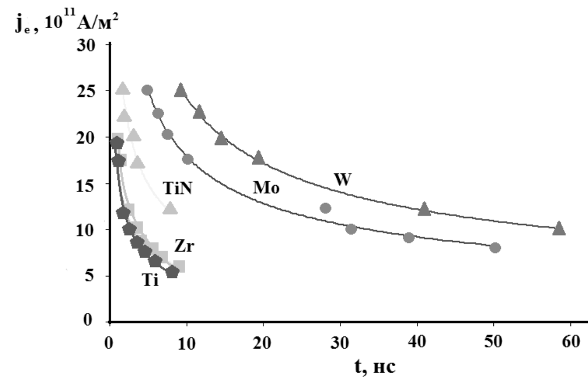

Fig. 1. Change the emitter heating time for different values of the emission current density.

The calculation in the model will improve the effectiveness of materials deposition by pre-determining the main technological parameters of sedimentation: current density, pulse discharge time, frequency UVH generation.

[1] P. Strzyzewski, M. J. Sadowski, R. Nietubyc *et al.*, *Mater. Sci. Poland.* **26** (2008) 213-220.
[2] Anders, *Handbook of Plasma Immersion Ion Implantation and Deposition* (John Wiley & Sons, New York 2000).
[3] E.A. Litvinov, G. A. Mesyats and D.I. Proskurovsky, *Physics-Uspekhi (Advances in Physical Sciences),* **139** (1983) 265-302.
[4] A.V. Nedolya, E.I. Pivaev, I.N. Titov. *J. PSE (Physical surface engineering),* **7** (2009) 330-334.