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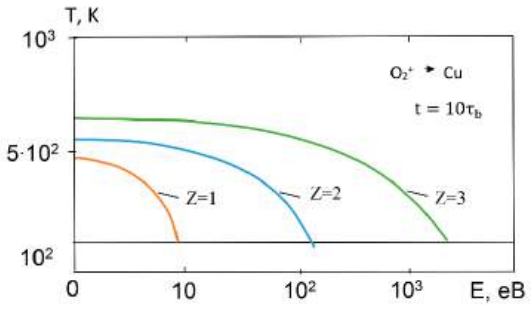
Shirokii Iu., Ph.D. technical sciences,
associate professor,
i.shyrokyi@khai.edu
Torosian O., assistant,
o.tarasyan@khai.edu
Torosian-Zhydieieva H., postgraduate
goarita888@gmail.com

OBTAINING NANOSTRUCTURES IN NEAR-SURFACE LAYERS

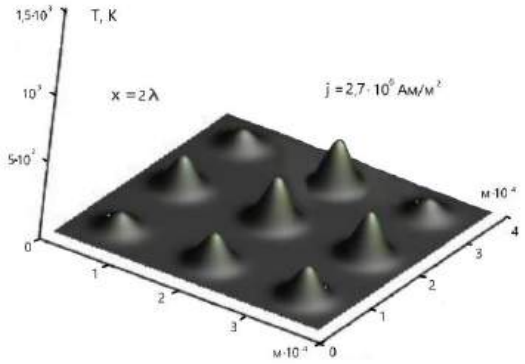
National Aerospace University named by N. E. Zhukovsky
"Kharkiv Aviation Institute"

The paper developed a mathematical model for describing the generation of temperature fields during ion-plasma treatment of the copper surface during the formation of nanostructures in the near-surface layers. Conducted studies of temperature fields during ion-plasma treatment of copper with oxygen ions show that it is possible to create temperature fields with high temperature gradients in a given plane $x = 0,5\lambda_m$, at a current density of J = $2.7 \cdot 10^6$ A/m^2 with fairly high temperature stress indicators (10^8 N/m), which will contribute to the formation of stable nanostructures. The created theoretical model is regulated and controlled. It will be in demand for improving the technologies for obtaining nanostructures by plasma-ion methods.

Also, thanks to the developed mathematical model, the structures of the temperature fields during the ion-plasma treatment of copper with a large number of oxygen ions for different particle penetration depths were obtained (Fig. 1).



a



b

Fig. 1. a – dependence of temperature on ion energy at different exposure times;
b – temperature distribution during the action of oxygen ions on copper at different depths, at a current density of J = $2.7 \cdot 10^6$ A/m^2

The developed model will contribute to a more accurate determination of technological parameters for the formation of conditions that will contribute to the stable growth of nanostructures in the near-surface layers of the processed materials. The temperature fields in the zone of action of ions were calculated for three levels of the plane of the surface layer depending on the depth of penetration of ions for different times of their interaction and at different current densities from $2.7 \cdot 10^6$ to $2.1 \cdot 10^8$ A/m^2.