ADDITIVE RECOVERY AT LATERAL BOUNDARIES OF GRAINS UNDER ELECTRONIC EXPOSURE

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ВЫДЕЛЕНИЕ ПРИМЕСИ НА ГРАНИЦАХ ЗЕРЕН В УСЛОВИЯХ ЭЛЕКТРОННОГО ОБЛУЧЕНИЯ.

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The experimental investigation of additive re-distribution under electronic beam revealed a recovery of the additive at grain boundaries. Additive accumulation mainly takes place at the boundaries that are perpendicular to material surface, whereas there is no an observed recovery of additive at the boundaries that are parallel to the surface.

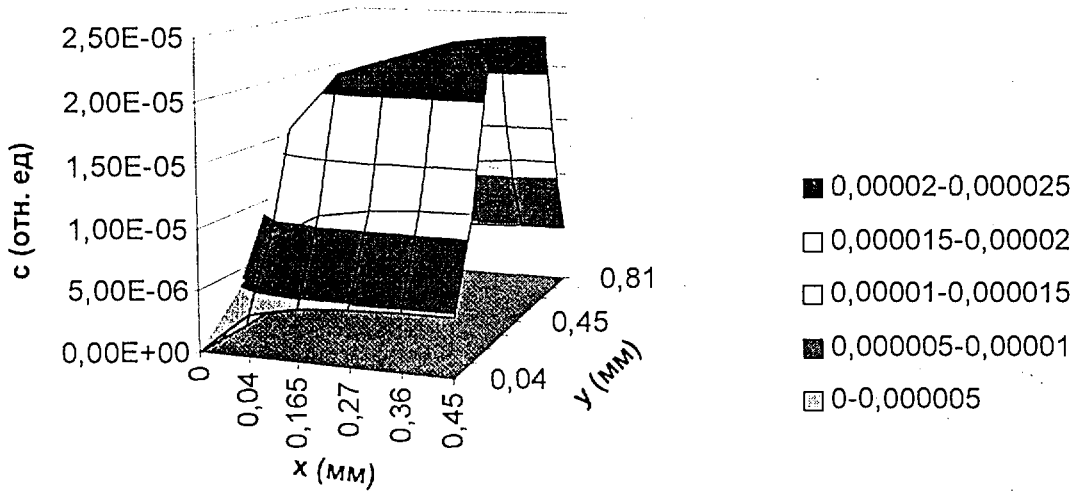
To construe the processes of additive recovery at grain boundaries, we may use the kinetic diffusion equation describing the mass transfer processes in the presence of temperature gradients and non-equilibrium vacancies [1, 2].

The additive recovery is caused by spot fault gradients near the grain boundary. The grain boundary is an intensive run-off region of vacancies. Therefore, the average vacancy distribution profile near the grain boundary changes its pattern (See Fig.). The above case indicates that there are two additive fluxes. One of them is vectored perpendicular to the surface, and the other one is parallel to it, i.e. it is vectored to the grain boundary. A study of the perpendicular and parallel boundaries shows that there is no additive settling at the boundaries that are parallel to the surface, since the general flux is vectored to the parallel boundaries. There is no such kind of phenomenon at the grain boundaries that are perpendicular to the surface. Besides, the perpendicular boundaries are more effective run-off regions for vacancies, since there is a slower build-up of the region with vacancies due to displacement of the vacancies to the surface.

To compute concentration of vacancies we will consider a grain on the surface as a model. The computations indicate the presence of vacancy gradients vectored to the surface and grain boundaries, which are perpendicular to the surface.

Distribution of the vacancies is presented in Figure.

Distribution of non-equilibrium vacancies in nickel along the grain area under electronic beam with the energy of 2.75 MeV and current density of 1 A/m^2



Distribution of vacancies along the grain area was used for computations of the mass transfer processes in alloys. The model of radiation-simulated mass transfer, developed in the course of the above activity, allowed construing the experimental data.

Comparison of the experimental and theoretical outcomes shows a good agreement between the theoretical model and actual processes occurring under the exposure. This theory discloses wide potentials for application of diffusion processes in alloys.

REFERENCES

1. *Plotnikov S.V., Postnikov D.V.* Mass transfer in alloys under electronic beam. Scientific Proceedings ICNPP' 99 «Nuclear and Radiation Physics», Almaty, 1999, 94-102.
2. *Postnikov D.V., Plotnikov S.V.* Computation of additive concentration under radiation effect // Scientific Proceedings. Ust-Kamenogorsk EKSU, 1997.-p. 112-113.

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