NUMERICAL MODELING OF THERMAL PROCESSES ARISING IN THE MATERIALS UNDER EXPOSURE TO PULSED ION BEAMS AND SINGLE HIGH ENERGY IONS

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Irradiation of materials with pulsed electron and ion beams can create completely new structures in the surface layers of the sample with very interesting physicochemical properties for practical purposes.

The interaction of charged particle beams can cause phase transitions. The study of thermal processes in the presence of phase transitions in systems (processes of melting and solidification of materials) is greatly complicated by the fact that the mathematical models of these processes are nonlinear boundary value problems. Theoretical consideration of the dynamics of phase transitions of the first kind leads to different versions of the Stefan problem.

Studies of the effects of highly ionizing charged particles on materials are becoming more and more important as accelerators with high energy heavy ions accumulator rings are created and put into operation. Such studies include, in particular, the study of the features of radiation sputtering and changes in the mechanical properties of materials when irradiated with high-energy heavy ions.

For the numerical solution of the above problems, students should acquire the following scientific skills:

1. Physical formulation of the problem (choice of mathematical model).
2. Mathematical formulation of the problem (initial and boundary conditions).
3. The choice of the algorithm and method of numerical solution.
4. The choice of programming language.
5. Analysis of the results obtained (comparison of the results obtained with the results of other authors and experiment). If the results are unsatisfactory, modify the model or look for another.