Mechanisms of damage and the evolution of the microstructure of materials under nonequilibrium conditions of the action of streams of ions of inert gases the study [[1]](#footnote-1)\*)

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Zmievskaya G.I.

Keldysh Institute of Applied Mathematics , Russian Academy of Sciences, zmig@mail.ru

Investigation of the mechanisms of damage to materials and the features of physical and chemical processes of surface melting and crystallization, heat and mass transfer, the formation and evolution of radiation defects, changes in the microstructure under the influence of high-energy pulsed fluxes of inert gas ions on the surface, computational methods have been developed [1] for assessing the degree and nature of damage to materials [2 ]. The formation of structural defects (blisters, craters, pre-cracks, etc.) and structures of vacancy-gas defects inside the coating, creating both defect clusters, were investigated in a radiation-resistant material - silicon carbide under conditions of irradiation with Xe ++ ions with energies from 5 to 10 keV; the process is considered as the formation of nuclei of a first-order phase transition by means of computational mathematics in terms of the kinetic theory of nonequilibrium processes. The SIC / Si samples in [2] are studied using scanning electron microscopy, ellipsometry, and confocal Raman microscopy. The formation of a porous layer includes several characteristic stages: the appearance of individual pores, their growth with the formation of structures and subsequent possible merging into a continuous layer and further destruction. Possible mechanisms for the formation of pore structures, a theoretical model of the Brownian motion of pores under the action of indirect elastic interaction through perturbation of oscillations of acoustic phonons, properties of porous materials that depend on the average thickness of the porous layer and the material in which the porous medium is created are discussed. The statistics of the "covers" of pores and craters as a result of their destruction at different exposure doses in the numerical experiment is comparable to the microscopic data at different exposure doses. Surface structure (with microscopic fluctuations in surface topography) can alter the mechanism of surface melting, erosion leading to cleaning and leveling, observed with repeated pulses of radiation exposure to the material. Data systematization is necessary for practical applications in the following areas: mechanisms of damage and surface modification of the materials under study under various types of exposure to ion fluxes; evolution of the structure and phase states, redistribution of the components of the materials under study under various types of their impact; characteristics of disordered porosity in samples consisting of layers ("dielectric / metal") at different layer thicknesses.

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Pt/ru/GP-Zmievskaya.docx) [↑](#footnote-ref-1)