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Defect formation in Zn nanostructures

Nowadays, one of the priority areas is the studying of defect formation processes and their subsequent evolution in nanomaterials after treatment of nanostructures with ionizing radiation. At the same time, the study of radiation-resistant nanomaterials and the creation of new functional devices by modification with ion beams require a comprehensive understanding and prediction of models for the formation and migration of defects. In this paper, we propose a model for defects formation in the crystal structure and their influence on physical-chemical and structural properties of zinc-based metal nanostructures. It was concluded that an increase in the irradiation dose leads to the appearance of non-uniform amorphous inclusions in the structure that are capable of initiating partial destruction of Zn nanotubes. In this case, for heavy ions Kr14+ and Xe22+ cascades of defects lead to the formation of porous regions on nanostructures surface that arises as a result of structure amorphization. The dimensions and number of subcascade and cascade inclusions increase when nanostructures are irradiated with heavy ion fluxes with an energy of more than 100 MeV, after the interaction of incident particles with lattice atoms. This leads to the partial destruction of structure and to a change in morphology. The understanding of energy transfer processes from energy ions to nanomaterials is necessary not only for basic research, but also for the manufacture of electronic and optical instruments, as well as for predicting nanomaterials characteristics operating under high radiation background conditions.

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