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HIGH ENERGY HEAVY ION RADIATION TOLERANCE OF CRYSTALLINE AND AMORPHOUS Si3N4

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The critical issue of modern nuclear energetics is the disposal of radioactive waste resulting from the nuclear fuel cycle. One of the promising ways to reduce their radiotoxicity is the neutralization of minor actinides using special diluents (matrices) of nuclear fuel, inert to the formation of radioactive isotopes and characterized by increased radiation resistance, in particular, to the effects of fission fragments. Silicon nitride (Si3N4) is a promising candidate material for inert matrix fuel host to be used for transmutation of minor actinides via nuclear reactions. Radiation-induced changes in this material are subjects of extensive studies. Radiation defects induced by swift heavy ions (SHI) simulating fission fragments impact still remain less studied in comparison with neutron and conventional (low energy) ion irradiation. The purpose of this work is to study the swift heavy ion induced radiation effects in different crystalline structured silicon nitride using high-resolution transmission electron microscopy (HRTEM). Si3N4 samples were irradiated with Bi and Xe ions having energies ranging from 156 to 714 MeV and electronic stopping powers - from 6 to 35 keV/nm at the IC-100 and U-400 FLNR JINR cyclotrons and the DC-60 cyclotron at the IRC INP. The latent track parameters and threshold value of electron stopping power for track formation were found for amorphous and crystalline Si3N4. Experimental results are considered within the framework of the inelastic thermal spike (i-TS) model.

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