Seminar

Institute for Plasma Research

Title : Investigation of swift heavy ion irradiation impact on alumina

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Time : 03:30 PM
Venue : Online- Join the talk:
https://meet.ipr.res.in/Dr.Paramita_Patra_PDFExtensiontalk

Abstract:

In swift heavy ion (SHI) irradiation, projectile ion loses its energy into the material due to elastic collisions with the positive nuclei, and inelastic collision with the electrons as well. The nuclear energy loss (S_n) is dominant at relatively low incident energies, whereas the electronic energy loss (S_e) is dominant at higher ion energies. SHI's are not expected to produce any observable atomic displacements due to predominant in-elastic collision. However, near the range of SHI in the material, elastic collision dominates which lead to atomic displacement. In the present work, we have estimated 100 MeV Au ion beam induced damage in Al_2O_3 using SRIM code and thermal spike (TS) model. Using SRIM code, we have determined displacements per atoms (DPA), projectile range and the variation of S_e and S_n with the depth at 100 MeV Au ion irradiation in Al_2O_3. The evolution of lattice temperature and damage /molten radius throughout ion track in Al_2O_3 for 100 MeV Au ion irradiation using three TS models: (i) in-elastic thermal spike (i-TS) model (S_e), (ii) elastic thermal spike (e-TS) model (S_n), and (iii) unified thermal spike (u-TS) model (combined effect of $S_e + S_n$) are investigated. The present result suggests that the molten radius produced in high energy and low energy regimes can be described by i-TS model and e-TS model respectively, but at the intermediate energy regimes when both S_e and S_n are significant, the u-TS model is to be considered for describing the evolution of lattice temperature and molten radius. Using u-TS model, we have observed a U- shaped energy dependence of molten radius (r_m) studied throughout the Au ion track on Al_2O_3. The results of the analytical study shall be further corroborated experimentally using 100 MeV Au ion irradiation with Al_2O_3 by varying fluences depending upon the determined DPA values.