deposited charge is about 1000 fC/μm, so the distribution varies between less than 800 and more than 1200 fC/μm. Since the critical charge of some sensitive devices has reached less than 1 fC, this variation is far from being negligible. So the simulated results are of some instructive significance to the analysis of experimental data.

References

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3 - 36 Irradiation Effects of Swift Heavy Ions on Chemical Composition of Mica Crystal

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Muscovite as a special mineral material is very sensitive to irradiation of swift heavy ions, and it has several applications, such as solidstate nuclear track detection, microfilitering, fission track dating in geology and so on. In our investigation, sliced muscovite, with formula $KAl_2(Si_3AlO_{10})(OH)_2$, was irradiated by 414.4 MeV (3.7 MeV/u) ^{112}Sn ionswith fluencerangefrom 1×10^{11} to 1×10^{14} ions/cm^2 from HIRFL accelerator. The chemical composition of irradiated samples was studied by X-ray Photoelectron Spectroscopy (XPS).

After irradiated by swift heavy ions, the surface of mica crystal was cleaved into small flakes at high fluencesuch as 1×10^{13} ions/cm^2. The relative content of elements K, Al, SiandC, asshown in Fig. 1(a), is determined with area normalization method anddescribed in the form of histogramin Fig. 1(b). It illustrates that the content of K and Aldecreaseswith the ion fluenceincreasing. It is interesting to note thatthe content of Si increases gradually at beginning. After the ions fluence reaches a certain threshold, the content of Si begin to decrease.

As we known, mica is consisted of negatively charged aluminosilicate sheets which are bound to alternating layers of K^+ ions. Because of the layered structure, mica can be easily cleaved. After irradiatedby high energy ions especially at high fluences, the outmost surface was cleaved into small pieces. Irradiation of swift heavy ionsdestroyed the bonds between K^+ ions and aluminosilicate sheets as well as the well-defined layered structure of mica surface, and removedthe K^+ ions on the outmost surface, which leads to the decreasing of K element on the top surface of samples. At higher fluences (1×10^{13}, 1×10^{14} ions/cm^2), the content of K was not observed in this experiment.

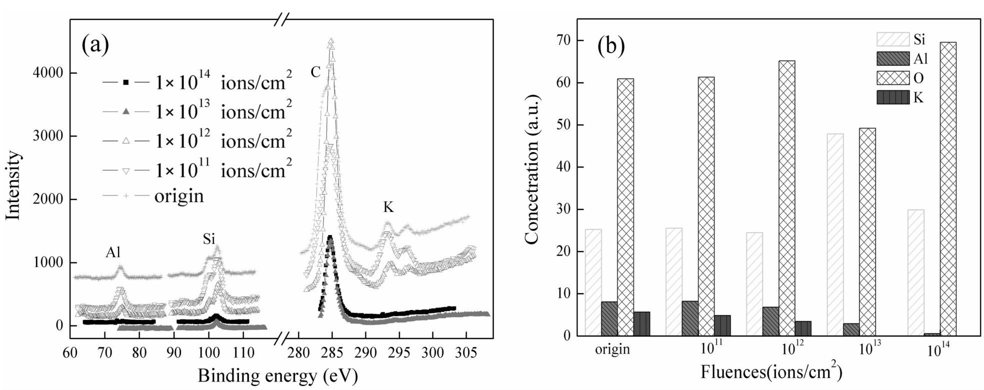

Fig. 1 Atomic concentration determined by XPS of irradiated mica surfaces at different fluences compared to pristine sample. (a) XPS spectra; (b) content distribution of K, Al and Si.

It was observed from Fig. 1(b) that at lower fluences, i.e. 1×10^{11} and 1×10^{12} ions/cm^2, the content of Si in mica has not been obviously changed. While at higher fluence 1×10^{13} ions/cm^2, an enrichment of

Si on the mica surface was detected, and then it decreases at fluence 1×10^{14} ions/cm^2. In addition, the content of element O on the surface is increasedat this fluence. It could be concluded that the O element detected on mica surface generally can be divided into two parts, the first one is from the pristine mica sample, and the second is the O element captured from the air. The activated bonds could capture O around as the swift heavy ions destroyed the bonds between K^+ ions and aluminosilicate sheets.

In conclusion, the chemical composition of mica was alternated by the irradiation of heavy ions. The investigation indicated that the surface of mica was cleaved, and the heavy ions destroyed the bonds that caused the decreasing of elements K and Alat the rangeof 1×10^{11} to 1×10^{14} ions/cm^2. In addition, it also has a great influence on the content of elements Si and O.

3 - 37 Irradiation Experiment of ODS Ferritic Steels with 122 MeV Ne Ions at HIRFL-SFC

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The Sector-focused Cyclotron (SFC) at HIRFL is a useful tool to simulate radiation damage in materials candidate to advanced nuclear reactors, because it can supply heavy ions ranging from ^{12}C to ^{238}U in high beam density, with kinetic energies typically in the range 1～10 MeV/u, which can penetrate pure iron up to 31 micrometers in depth and produce atomic displacement at a rate around 0.1 dpa/h. To meet a variety of demand for irradiation of candidate materials, we recently developed a new chamber at the terminal of SFC. The new chamber includes an energy degrader which enables a uniform distribution of atomic displacement damage and injected ions within the projective range in specimens, a cooling (liquid nitrogen) stage, a hot (up to 600 ℃) stage for specimens of materials. On both stages up to five specimens can be mounted at once for irradiation. An overview of the chamber and a SRIM estimate of the depth distribution of atomic displacement damage by 122 MeV Ne ions in Fe-base specimens are shown in Fig. 1. The new chamber enables the simulation of irradiation conditions of materials at both low temperatures like near the superconducting coils in fusion reactors and at high temperatures at the first wall in fusion reactors or near the cladding of nuclear fuels in fast breeder reactors.

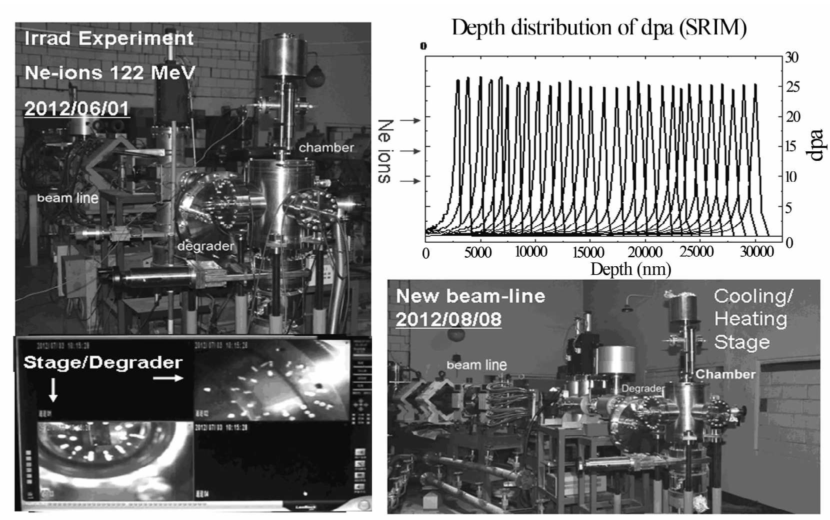

Fig. 1 Overview of the new chamber with an energy degrader at HIRFL-SFC, with an inset showing a SRIM estimate of the depth distribution of dpa in Fe-base alloys.

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