

### 3 - 18 Investigations of Latent Track and Vibrational Spectra of Muscovite Mica Irradiated by Swift Heavy Ions

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Muscovite mica sheets with a thickness of 12  $\mu\text{m}$  were irradiated by swift heavy ions Kr and Bi from Heavy Ion Research Facility in Lanzhou(HIRFL). The fluences range from  $1 \times 10^{10}$  to  $1 \times 10^{12}$  ions/ $\text{cm}^2$ . The electronic energy loss  $(dE/dx)_e$  increases from 5.9 to 31.5 keV/nm. The vibrational modifications in irradiated mica were investigated by Fourier-transform infrared spectroscopy and the latent tracks were observed by transmission electron microscope (TEM). The infrared spectrum shows that motions from all atom types in the muscovite mica structure could be found in modes for all vibrations. As shown in Fig. 1, the intensity of all vibrational modes in mica, including the OH stretch motion at  $3621 \text{ cm}^{-1}$ , decreased with the increasing  $(dE/dx)_e$ . The similar tendency is found in samples irradiated by swift heavy ions with increasing ion fluence. It is indicated that defects and structural modifications generated during swift heavy ion irradiation, and more defects are introduced by irradiation with higher ion fluence.

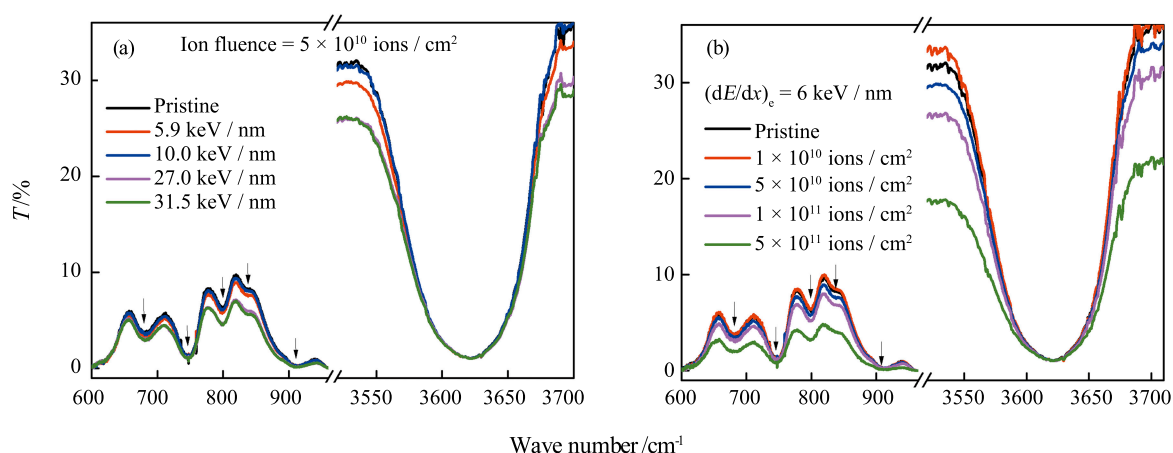


Fig. 1 (color online) IR spectra of mica irradiated by SHIs with a fluence of  $5 \times 10^{10}$  ions/ $\text{cm}^2$  at different  $(dE/dx)_e$  (a) and with a  $(dE/dx)_e$  of 6 keV/nm at different fluences(b).

Fig.2 shows TEM images of latent tracks in mica irradiated by Bi ions with a  $(dE/dx)_e$  of 31.5 keV/nm. According to Fig.2(a), the track core represents an amorphous zone with a sharp boundary. The latent track in mica irradiated by Bi ions has a nearly circular shape. As shown in Figs.2(b) and (c), the track expanded outwards obviously during the testing process, which indicates that the structure of the track halo is sensitive to electron bombardments. The undisturbed area around the latent track caused by swift heavy ion irradiation turns to be amorphous due to the electron bombardments.

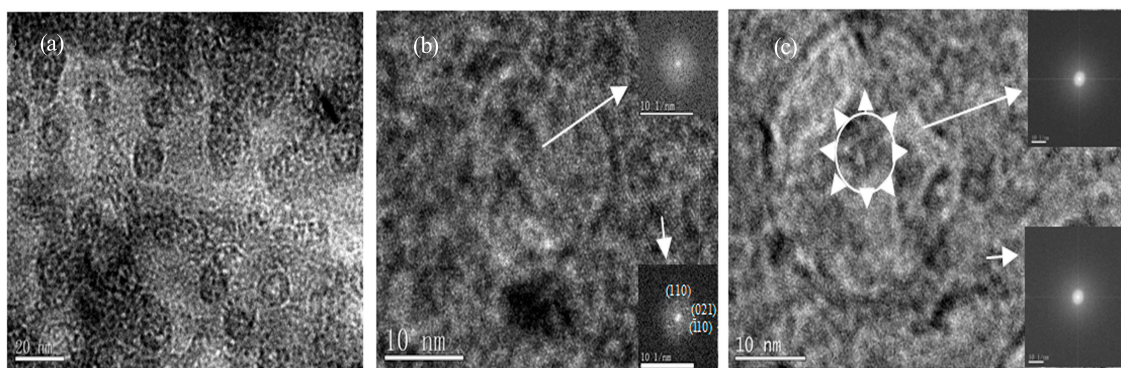


Fig. 2 Variation of latent tracks induced by pre-irradiated by Bi ions with a  $(dE/dx)_e$  of 31.5 keV/nm. (a) TEM image of latent track induced by SHI irradiation. (b) Image of a single latent track and the diffraction patterns in and around the track core. (c) Track after electron bombardment and the diffraction patterns.