

3 - 45 Single Ion Hit Test of CENA System

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Single Event Effects (SEE) is a main problem threatening space aircrafts. Single ion irradiation using a microbeam system is useful in the study of the generation mechanism of SEE in semiconductor devices^[1]. Moreover, single ion irradiation system can be used to study DNA damage and bystander effect induced by ionizing radiation. The microbeam facility in IMP has the advantage of various heavy ions with high energies, thus is suitable for spatial study in both material applications and biology studies. A beam control and irradiation system, named Cell Exposure and Nuclear Application (CENA), has been developed at the IMP microbeam facility for the above mentioned purposes. In this system, the CENA program provides two scan modes; one is the matrix scan in which the scan size, step distance, dwell time and ions per position of the matrix can be defined; in the other mode coordinate list or image files can be loaded from hard disk and used for pattern irradiation.

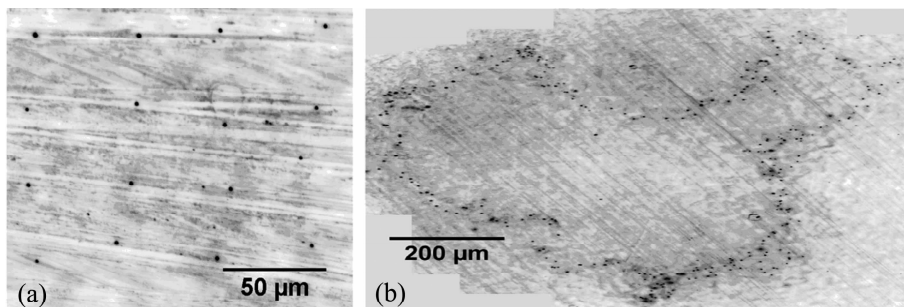


Fig. 1 Microscope images of the etched PC films, (a) irradiated in matrix scan mode and (b) in pattern irradiation mode, both with single ion manipulation technology.

The single ion hit of the CENA system was tested using an ion beam of dozens micrometer with $^{86}\text{Kr}^{26+}$ at 25 MeV/u. The samples of 30 microns thick polycarbonate (PC) films were placed under the exit window of microbeam and upon a silicon detector. After irradiation, the PC films were etched in 5 M NaOH solution at 50 °C for 3 h. Fig. 1 shows the microscopic images of etched PC films. Fig. 1(a) shows a part of the sample irradiated in matrix scan mode, each dot on the sample indicates the etched track of single ion hit, and the instability of hit position was mainly induced by the defective power supply of focusing quadruple magnets Q5 during the beam time. In comparison, a China map was written onto a PC film in pattern irradiation mode, as showing in Fig. 1(b), the film clearly shows the outline of the China map. All these two samples demonstrate the capability of the CENA system in delivering ions to arbitrary positions. In other words the CENA system has preliminary achieved the goal of single ion manipulation, and the improvement is still going on.

Reference

[1] Tomihiro Kamiya, Toshio Hirao, Yasuhiko Kobayashi, Nucl. Instr. and Meth., B(2004)219.