

Recent progress in emulsion technology to study fragmentation reactions of high energetic ion beams

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The R&D project to study nuclear fragmentation using emulsion in attempt to improve the accuracy of dose calculation in carbon ion therapy had been performed as NIRS HIMAC P152 experiment since 2003. The charge-changing cross sections of 200-400MeV/n carbon on water and polycarbonate were measured in this experiment [1,2]. Validation of Monte Carlo codes build in Geant4 to simulate fragmentation reactions is advancing [3]. Based on this technique, NIRS HIMAC P231 experiment to measure the cross sections for various combinations of beams and target materials was launched in 2007. In this experiment, we adopt the gold deposition development [4] instead of normal silver development and hybrid apparatus with CR-39 in order to improve the charge identification. We present the details of experimental technique, some preliminary results of P231 experiment and future prospect of fragmentation study using emulsion.

[1] T. Toshito *et al.*, *Nucl. Instr. and Meth.* **B556** (2006) 482.

[2] T. Toshito *et al.*, *Phys. Rev.* **C75** (2007) 054606.

[3] T. Toshito, *IEEE Nuclear Science Symposium 2007 Conference Record N40-3, Honolulu, Hawaii, USA.*

[4] K. Kuge *et al.*, *Radiat. Meas.* **42** (2007) 1335.