Fragmentation Cross-section measurements with Ca and Ni isotopes

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Projectile fragmentation is used extensively to produce rare isotopes at many radioactive isotope facilities such as the National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University. The understanding the mechanisms behind the production of rare isotopes using neutron-rich beams is important for the operation of many current facilities such as NSCL, GSI, RIKEN, GANIL as well as future facilities like GSI/FAIR, RIKEN/RIBF and the Rare Isotope Accelerator, (RIA).

We have studied the fragmentation yield dependence on the asymmetry of the primary beam and targets. The fragments emitted from the collisions of ^{40,48}Ca and ^{58,64}Ni beams produced by the K500-K1200 Coupled-Cyclotron Facility at the NSCL on ^{9}Be and ^{181}Ta targets were identified with the A1900 mass separator. The cross sections of about 200 isotopes have been measured for the projectile fragmentation of ^{48}Ca and ^{58,64}Ni beams. For ^{40}Ca beams, the cross-sections of about 100 isotopes have been obtained. We have also measured the fragment cross-sections produced from projectile fragmentation of the unstable beams of ^{68}Ni and ^{69}Cu. These secondary beams were selected with the A1900 mass separator and the emitted fragments were identified with the S800 spectrometer. The experimental cross-sections from all these reactions will be compared to EPAX2, a phenomenological parameterization of the fragment cross-sections used in most facilities to predict rates of secondary beams as well as more realistic models such as the abrasion-ablation models. To understand the reaction mechanisms for rare isotope productions, results from dynamical calculations such as the Asymmetrized Dynamical Model will also be discussed.

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