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Momentum distributions and production cross sections of projectile-like fragments at E/A=290 MeV

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To disclose the mechanism of projectile fragmentation process at intermediate energies, cross-sections for production of projectile-like fragments (PLFs) and their momentum distributions were measured. The experiments were performed with Ar-beam of $E/A = 290$ MeV, accelerated by HIMAC accelerator at NIRS, and various targets(C, Al, Nb, Tb, and Au). The identification and measurement of momentum of PLFs were performed by ISOL. The longitudinal momentum (P_L) distributions of PLFs were analyzed by Gaussian function. The Goldhaber value σ_0 derived from the fitting does not show significant dependences on fragment or target and is consistent with that previously measured at relativistic energies $E/A > 1$ GeV. The broadening of transverse momentum (P_T) distributions increases with target mass. Especially, P_T distribution of ^{39}Cl becomes off-center distributions for Tb and Au target. This phenomenon will be explained by the deflection of orbit caused by the Coulomb repulsion. By integrating observed momentum distributions, cross-sections for production of PLFs (σ_F) with $A_F = 5 \sim 18$ were derived. Observed σ_F and its target effect are well reproduced by EPAX, except for neutron-deficient fragments. The even-odd systematics and the enhancement of productivity for PLFs with Z(N)=8 are observed in isotopic and isotonic distributions of σ_F. The systematics cannot be reproduced by EPAX or statistical abrasion-ablation model and is investigated based on nuclear structural effects. The present results are useful to predict the intensity of radioactive nuclear beam (RNB) produced at next generation RNB facilities and to improve the heavy ion cancer therapy.

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