Production cross section measurement for radioactive isotopes produced from ^{78}Kr beam at 345 MeV/nucleon by BigRIPS separator

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We have measured the production rates and the production cross sections for a variety of radioactive isotopes (RIs), which were produced from a ^{78}Kr beam at an energy of 345 MeV/nucleon using the BigRIPS separator[1)], for the first time. Proton-rich isotopes with atomic numbers $Z = 22{-}37$ were produced by the projectile fragmentation of the primary beam on a 5-mm-thick Be production target. The particle identification of RIs was based on the TOF-$B\rho$-ΔE method in the second stage of the BigRIPS[2)].

The production cross sections were deduced from the measured production rates and the transmission efficiency in the BigRIPS separator, which was simulated with the calculation code LISE^{++}[3)]. In the LISE^{++} simulation, the parametrization for momentum distribution of the RIs was adjusted, because the exponential tails in the low-momentum regions observed in the experiment fell off faster than those calculated by the LISE^{++} with the original parametrization. In preliminary, we used the parameters of the momentum distribution, which were obtained in the production cross-section measurement of proton-rich nuclei produced from the 345-MeV/nucleon ^{124}Xe beam. The parameters of the angular distribution were not changed from the original values in the code.

Figure 1 shows the production cross sections of RIs obtained in the ^{78}Kr-beam campaign. The solid and dashed lines in Fig. 1 show the cross sections predicted from the empirical formulae EPAX3.1a[4)] and EPAX2.15[5)], respectively. EPAX3.1a predicts the cross sections better than EPAX2.15, which overestimates most of them. The measured cross sections of RIs with a wide range of Z are fairly well reproduced by EPAX3.1a; however, some isotopes show systematic discrepancies around the very neutron-deficient region. In the case of ^{67}Kr, which is the most neutron-deficient Kr isotope in our measurement, the experimental cross section is $(3.2 \pm 1.4) \times 10^{-12}$ mb (preliminary), while the value calculated using the EPAX3.1a formula is 4.25×10^{-10} mb. Further, we also observe that the discrepancy becomes significant with increasing Z number. These discrepancies were also observed in proton-rich RIs produced from the 345-MeV/nucleon ^{124}Xe beam[6)].

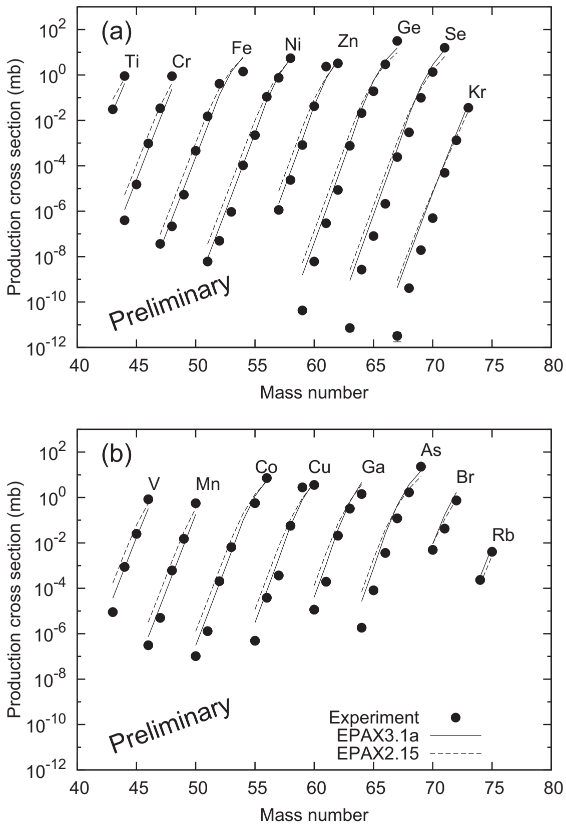

Fig. 1. Production cross sections of RIs produced in the ^{78}Kr + Be reaction at 345 MeV/nucleon with the predictions of EPAX parametrizations (Preliminary). (a) Results for even-Z isotopes. (b) Results for odd-Z isotopes. Solid and dashed lines show the values predicted using the EPAX3.1a and EPAX2.15 formulae, respectively.

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