Production cross section measurements of radioactive isotopes produced from a ^{124}Xe beam at 345 MeV/u by the 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 ^{124}Xe beam at an energy of 345 MeV/u using the BigRIPS separator.[1] Proton-rich isotopes with atomic numbers $Z = 34-52$ were produced by the projectile fragmentation of the beam on a 4-mm thick Be production-target. The particle identification of RIs was based on the TOF-$B\rho$-ΔE method.[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 LISE^{++} code.[3] In the LISE^{++} simulation, the parametrization for momentum distribution was adjusted, because the exponential tails in the low-momentum regions fell off faster than those in the LISE^{++} calculation with the original parametrization for the 345-MeV/u ^{124}Xe + Be reaction.[4]

Figure 1 shows the production cross sections of RIs obtained in three experiments, including our first ^{124}Xe-beam experiment[4] with predictions of the EPAX empirical cross-section formulae. The type of symbols represents the experiment from which the data were obtained. The filled symbols indicate that the distribution peak is located inside the slit opening at each focus, while the open symbols indicate that the peak is located outside the opening. The deduced cross sections of the same isotopes obtained in different settings / experiments were fairly consistent with each other, even though some isotopes were accepted only their low-momentum tails in the separator. This indicates the reliability of our measurements and simulations with LISE^{++}.

The solid and dashed lines in Fig. 1 show the cross sections predicted from the empirical formulae EPAX3.1a[5] and EPAX2.15,[6] respectively. EPAX3.1a predicts the cross sections better than EPAX2.15, which overestimates them. The measured cross sections of RIs with a wide range of Z are fairly well reproduced by EPAX3.1a, although some isotopes show systematic discrepancies in the highly neutron-deficient region. For ^{100}Sn, our experimental cross section at 345 MeV/u is approximately 1/6 of that predicted by EPAX3.1a. Further, the discrepancy becomes significant in the large Z region.

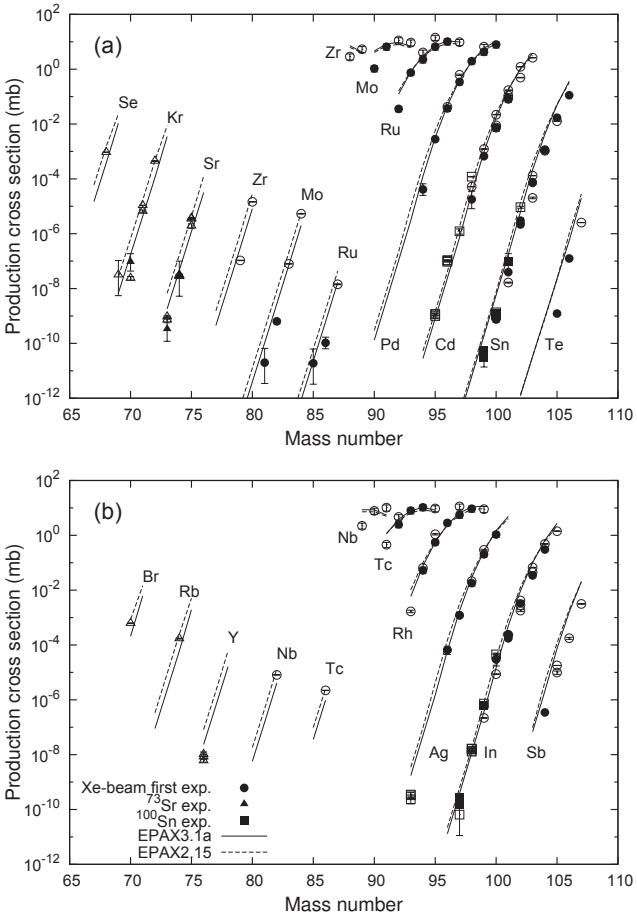

Fig. 1. Production cross sections of RIs produced in the ^{124}Xe + Be reaction at 345 MeV/u with the predictions of EPAX parametrization. (a) Results for even-Z isotopes. (b) Results for odd-Z isotopes.

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References

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