Measurement of cross-sections and momentum distributions of isotopes produced from ^{18}O beam

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The cross-sections of ^{1,2,3}H, ^{3,4,6,8}He, ^{6,7,8,9,11}Li, ^{12,14}Be, ^{15,17}B, and ^{17}C produced from an ^{18}O beam at 250 MeV/nucleon were systematically measured with the Superconducting Radioactive Isotope Beam Separator (BigRIPS).[1] In the previous machine study,[2] the cross-sections were measured for mainly proton-rich isotopes, and many neutron-rich isotopes were not measured systematically due to time limitations and other factors. Therefore, cross-section measurements were conducted mainly on the neutron-rich side at the optimum setting. In addition, the momentum distributions of ^{8}He and ^{1}H were measured for a wide range.

The secondary beam was produced from the ^{18}O beam on a 2 mm-thick Be target at F0. The momentum slit at F1 was set at ±3%. An 8 mm-thick Al achromatic degrader was used at F1 to purify the secondary beam. The particle identification was performed by using the energy loss in the plastic scintillator at F7 (ΔE) versus time-of-flight information from F3 to F7 (TOF37) in the second stage of BigRIPS. For each cross-section measurement, the $B\rho$ setting was adjusted to 1% lower than suggested by the LISE^{++} package[3] to accommodate the momentum peak based on our previous experience. The ^{18}O primary beam intensity was measured using the beam monitor to detect the light-charged particles recoiling out of the F0 target. The production cross-sections were deduced from the measured production rates and transmission efficiency of the BigRIPS separator estimated using the simulation code LISE^{++}.

The measured production cross-sections are shown in Fig. 1. The red symbols show the results of this work, whereas the blue symbols are the results of a previous machine study. Data older than the previous machine study are also shown in green symbols for reference. The statistical errors are smaller than the size of the symbols. By combining these results, we obtain the cross-sections of most isotopes produced from the ^{18}O beam, with the exception of several stable nuclei that overlapped with the primary beam or were too low in primary beam intensity to be measured by the beam monitor. Purple symbols are predictions of EPAX 3.1a,[4] and the lines serve just to guide the eye. They are acceptable for isotopes heavier than Li, especially for the neutron-rich side, but fail to reproduce the H and He isotopes. Detailed analyses are in progress.

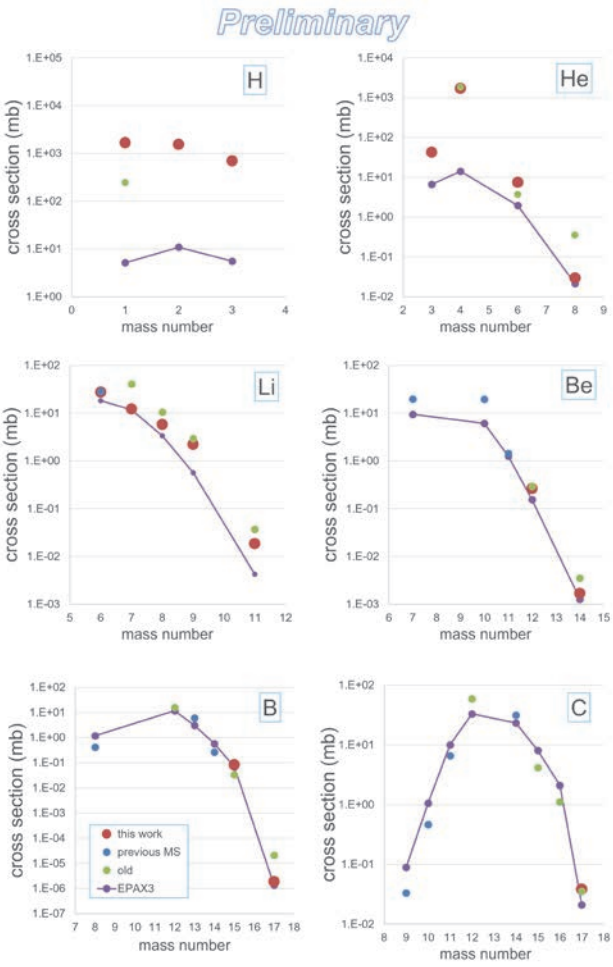

Fig. 1. Cross-sections of isotopes produced in the ^{18}O + Be reaction. Red and blue symbols are results of this and a previous machine study, respectively. Data older than the previous machine study are shown by green symbols for reference. Purple symbols are predictions of EPAX 3.1a. The lines are just to guide the eye.

References

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