Interaction cross section measurement of neutron-rich nuclei ^{17,19}B

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We report the interaction cross section measurements of $2n$-halo nuclei ^{17}B and ^{19}B on a carbon target at 270 and 220 MeV/nucleon, respectively, using the SAMURAI spectrometer at RIBF. The neutron halo is one of the most notable features found in light nuclei located in the vicinity of the neutron drip line. The drip-line nucleus ^{19}B has attracted much attention because of its low two-neutron separation energy (S_{2n}=0.14(39) MeV[1)]) and the high matter radius ($\tilde{r}_m$=3.11(11) fm) determined from the interaction cross section (σ_{I}=1219(81) mb) at an incident energy of approximately 800 MeV/nucleon[2)]. These results suggest the neutron halo structure in the ground state of ^{19}B, and its microscopic structure is not well understood owing to the large uncertainties of measured S_{2n} and σ_{I}. Further experimental studies are thus called for to clarify the detailed nuclear structure, such as the valence neutron configuration, core excitation, possible $4n$ halo/skin[2)], and He-Li cluster configuration.[3)] The goal of the present measurement is to obtain the interaction cross section of ^{19}B with an improved accuracy together with that of ^{17}B at approximately 250 MeV/nucleon.

The details of the detector setup of SAMURAI are described in Ref. 4). A cocktail beam of ^{17,19}B was produced via the fragmentation reaction of a ^{48}Ca beam on a 30-mm-thick beryllium target at 345 MeV/nucleon. The ^{17,19}B beams impinged on a carbon secondary reaction target (thickness1.8 g/cm^2) installed at the SAMURAI target area. The particle identification (PID) before the carbon target was performed using BigRIPS with the TOF-ΔE-$B\rho$ method. Figure 1 shows a PID plot of incoming beams reconstructed by TOF measured using plastic scintillators, $B\rho$ obtained from the horizontal position at F5, and ΔE measured using an ionization chamber (ICB) at F13. The beam profile on the target was obtained using two drift chambers (BDC1 and BDC2). The PID plot of the outgoing charged particles from the ^{19}B + C reaction, obtained using SAMURAI, is shown in Fig. 2, where the incident ^{19}B beam is selected. TOF and ΔE were obtained using the plastic scintillator hodoscope (HODF). The $B\rho$ value was reconstructed from the positions and angles measured by two drift chambers (FDC1 and FDC2). The resolution of mass-to-atomic-number ratio (A/Z) and atomic number (Z) for the outgoing ^{19}B are 0.04 and 0.19 (FWHM), respectively. The achieved resolutions are sufficiently high to identify the charged particle unambiguously. The interaction cross sections are then obtained by the transmission method. Further analysis to obtain the final interaction cross sections for ^{17,19}B is in progress.

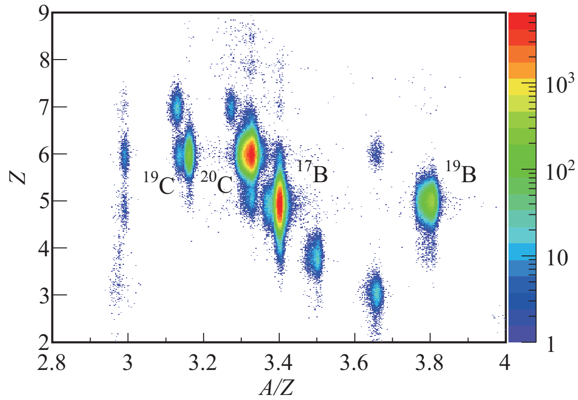

Fig. 1. Particle identification for the beam particles extracted from the data obtained using the standard BigRIPS detectors.

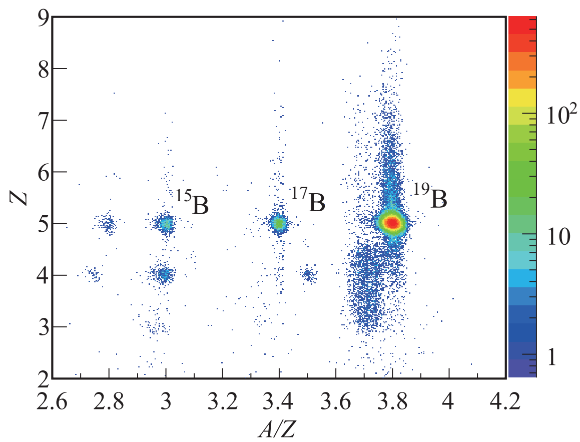

Fig. 2. Particle identification for the outgoing charged particles after the carbon target extracted from the data obtained using the SAMURAI detectors after selecting ^{19}B from Fig. 1.

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