Analysis of ^{48}Cr(p, n) reaction in inverse kinematics

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In this report, we present the progress of data analysis of the SAMURAI11 experiments performed at the RI Beam Factory of RIKEN Nishina Center in the spring of 2019. These experiments were conducted to measure the (p, n) reaction on $N = Z$ unstable nuclei, ^{48}Cr and ^{64}Ge. Previously, in Refs. 1) and 2), we reported the experimental setup and the particle identification (PID) analysis of the reaction residues using the SAMURAI spectrometer,[3)] respectively. Herein, we present the analysis of the data recorded using the particle analyzer neutron detector of real-time acquisition (PANDORA)[4)] system.

The PANDORA neutron detector setup consists of 37 plastic scintillators and was placed on the left and right sides of a liquid hydrogen target.[5)] The neutron-gamma pulse-shape discrimination method was employed to separate low-energy neutrons from the gamma-ray background. The neutron kinetic energies were deduced employing the time-of-flight method, whereas the neutron scattering angles of the (p, n) reaction in the laboratory frame were determined from the scintillator bar positions.

Figure 1 shows the kinetic curve for the ^{48}Cr$(p, n)^{48}$Mn reaction. Here, the reaction residue ^{47}Cr was selected from the PID analysis. ^{47}Cr is produced via the proton emission from the excited states of ^{48}Mn populated by the (p, n) reaction. The proton separation energy of ^{48}Mn is 2.05 MeV. We successfully identify a locus along the curve corresponding to 4 MeV excitation energy of ^{48}Mn, above the separation energy. Figure 1 shows events due to the background in a low kinetic-energy region below 500 keV. A further analysis is ongoing to substract the background.

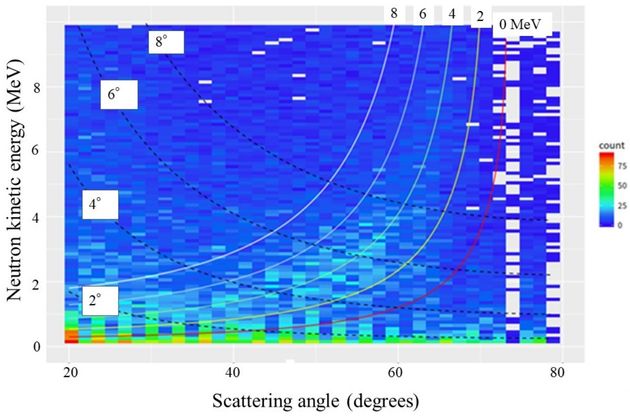

Fig. 1. Two-dimensional plot of neutron kinetic energy vs. neutron scattering angle in the laboratory frame. Solid and dashed curves represent the excitation energies and scattering angles in center-of-mass system of ^{48}Cr(p, n) reaction, respectively.

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