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Production of n-rich nuclei via 2-proton knockout with deuterium target

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Production of neutron-rich nuclei through one-nucleon knockout (p,2p) reactions has been successfully demonstrated with the MINOS at RIBF. In future RIBF experiments, a method to remove more than one protons with a reasonable rate will be required for production of more neutron-rich nuclei. At present there is no consensus on what the best reaction for two-proton removal is. In this presentation, a performance of the (d, 3pn) reaction with the MINOS as a candidate of the two-proton knockout driver in future RIBF experiments is discussed. The experiment was carried out using the SAMURAI spectrometer. A secondary cocktail beam including 58Ti was produced with projectile fragmentation reactions of a primary 70Zn beam at 345 MeV/u impinging on a beryllium target. The liquid hydrogen and deuterium with thicknesses of 1.1 g/cm2 and 1.8 g/cm2, respectively, were used as the secondary targets. The cross sections were derived by counting the numbers of particles before and after the target, considering an effective beam intensity. The secondary beam and fragments were identified event by event using the ΔE–TOF–Bρ method. It was found that cross section for two-proton removal with a deuteron target is larger by a factor of ~3 than that with a proton target. This fact may imply possible advantages of a deuteron target to produce neutron-rich nuclei via two-proton knockout.

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