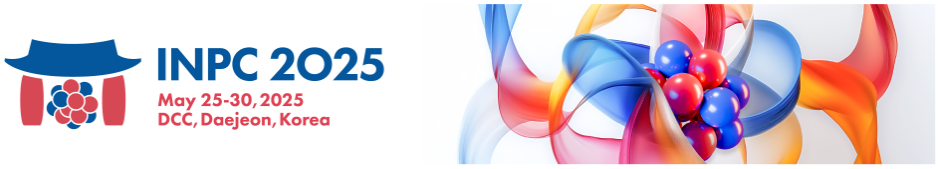

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Measurement of ground-state and isomeric-state ratio in nuclei produced in multinucleon transfer reactions using JAEA Recoil Mass Separator

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Multinucleon transfer (MNT) reaction is attracting interest in the field of astrophysics and superheavy-element research as the reaction can produce neutron-rich actinide and superheavy nuclei. In contrast to fusion-evaporation residue, however, reaction mechanism such as excitation energy and spin distributions of the primary excited compound nucleus is not understood, which will significantly impact the cross sections of produced evaporation residues (ERs), as it will determine survival probability to produce ERs in competition to fission. We are investigating the MNT reaction by directly detecting ERs using the Recoil Mass Separator (JAEA-RMS[1]) at the JAEA tandem accelerator facility. Since the JAEA-RMS features a rotation mechanism (0~40 degrees) around the beam direction, detailed measurement of ER cross sections as a function of recoil angle is possible. The first experiment was performed with the 30Si+209Bi reaction. The ERs transported through the JAEA-RMS were implanted in a silicon strip detector, and the subsequent alpha decay was measured to identify produced nuclei, as well as ground state and isomeric state. The results became the first demonstration of the in-flight separation and on-line decay measurement at finite angles. We observed remarkable differences in the cross sections between high-spins isomeric state and low-spin ground state(212At(9-)/212At(1-), 214Fr(8-)/214Fr(1-), 211Po(25/2+)/211Po(9/2+)), which should have a memory of spin distribution of compound nucleus.

Reference

[1] H. Ikezoe et al., Nucl.Instrum.Methods Phys.Res.A 376, 420 (1996)

Keywords : Multinucleon transfer reaction, Evaporation residue, Recoil mass separator, Isomer-to-ground state ratio

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