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Multi-nucleon transfer reactions populating neutron-rich actinide nuclei for fission study

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We are promoting a campaign to study multi-nucleon transfer reactions to populate excited states in neutron-rich actinide nuclei which cannot be accessed by particle capture and/or fusion reactions. Main purpose of this program is to study fission in new region of chart of nuclei. As a first step we studied reactions using the ^{18}O beam ($\sim$ 9MeV/u) and actinide target nuclei such as ^{238}U, ^{237}Np, ^{248}Cm. The experiment was carried out at the tandem facility of Japan Atomic Energy Agency. Ejectile nuclei generated in the reaction were identified by a newly developed silicon ΔE-E detectors (ΔE=75μm, E =300μm). Using this detector, clear separation up to oxygen isotopes (^{16,17,18,19}O) was obtained as well as lighter element isotopes (Be, B, C, N). The number of produced nuclei amounted to more than fifteen in one reaction. Two fragments emitted in multi-nucleon transfer fission were detected by multi-wire proportional counters, and fission fragment mass distributions (FFMDs) were measured for each isotopes. In the comparison of measured FFMDs with a calculation based on the fluctuation-dissipation model, it was found that the excited states up to more than 60MeV was populated. Measurement of fission fragment angular distribution relative to the recoil direction suggested the increase of the spin with the number of transferred nucleons.

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