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Test of 107Pd transmutation with macroscopic quantities/107Pd 核変換実証試験

Palladium is one of the nuclides targeted for recycling from spent nuclear fuel. Reasonable nuclear reaction paths for ^{107}Pd and the cross-sections for proton- and deuteron-induced spallation in inverse kinematics have been investigated [1]. However, a transmutation experiment using long-lived fission products as the target would be required for an actual system. To experimentally demonstrate the feasibility of ^{107}Pd transmutation by deuteron irradiation under continuous irradiation with the existing azimuthally varying field (AVF) ring cyclotron at RIKEN RIBF, we conducted a test with macroscopic quantities to transmute ^{107}Pd by deuteron beams produced by the accelerator [2].
To effectively detect the reaction products of the ^{107}Pd + d reaction, we prepared a material with a ^{107}Pd-concentration of almost 100\% by ion implantation. The implanted samples were irradiated for several days with deuterons produced by the AVF ring Cyclotron at RIKEN RIBF. After cooling, gamma-ray measurements of the irradiated sample were conducted. ^{105}Pd and ^{106}Pd produced from transmutation of ^{107}Pd were estimated using DCHAIN. The ^{107}Pd in the irradiated samples were measured by ICP-MS. The isotopic ratios ^{105}Pd/^{107}Pd and ^{106}Pd/^{107}Pd obtained from the experimental results were compared with those obtained by calculation using PHITS.
In this paper, an outline of the test of ^{107}Pd transmutation with macroscopic quantities is presented and certain experimental results are reported.

References
[1] H. Wang et al., “Spallation reaction study for the long-lived fission product ^{107}Pd”, Prog. Theor. Exp. Phys. (2017) 021D01.
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Primary author: MIYAKE/三宅, Yasuto/泰斗 (RIKEN Nishina Center/理化学研究所仁科加速器科学研究センター)

Co-author: OKUNO/奥野, Hiroki/広樹 (RIKEN Nishina Center/理化学研究所仁科加速器科学研究センター)

Presenter: MIYAKE/三宅, Yasuto/泰斗 (RIKEN Nishina Center/理化学研究所仁科加速器科学研究センター)

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