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Title(English)	
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論 文 要 旨

THESIS SUMMARY

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学生氏名： Student's Name	寺田　和司	指導教員（主）： Academic Advisor(main)	井頭　政之
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

The nuclear transmutation of Long-Lived fission Products (LLFPs: ^{79}Se, ^{93}Zr, ^{99}Tc, ^{107}Pd, ^{126}Sn, ^{129}I, ^{135}Cs, etc) produced in fission reactors into stable or short-lived nuclides by neutron capture reaction is expected to reduce the impact of nuclear waste disposal on the environment. Therefore, the neutron capture cross sections of LLFPs are very important for the study on the nuclear transmutation. On the other hand, some of stable isotopes related to LLFPs are also produced in fission reactors. Therefore, the capture cross sections of those stable isotopes are also important for the evaluation of the performance of transmutation systems which do not adopt isotope separation. In the case of ^{107}Pd, one of important LLFPs, the stable isotopes of ^{104,105,106,108,110}Pd are also produced together with ^{107}Pd in fission reactors. Therefore, the capture cross sections of those stable isotopes are also important for the transmutation study of ^{107}Pd. From this viewpoint, we measured the capture cross sections and capture gamma-ray spectra of ^{104,105,106,108,110}Pd in the neutron energy region from 15 to 100 keV and at 550 keV. Furthermore, we measured the capture cross sections of ^{107}Pd in the neutron energy region from the thermal to several hundred keV. In addition, the theoretical calculation was made by using the CCONE computer code.

The keV-neutron capture cross sections and capture gamma-ray spectra of ^{104,105,106,108,110}Pd were measured in the energy region from 15 to 100 keV and at 550 keV by using the 3 MV Pelletron accelerators at the Research Laboratory for Nuclear Reactors of the Tokyo Institute of Technology. A neutron time-of-flight method (TOF) was utilized with an anti-Compton NaI(Tl) spectrometer and a 1.5 ns pulsed neutron source by the ^{7}Li(p,n)^{7}Be reaction. The incident neutron energy spectra were measured by means of a TOF method with a ^{6}Li-glass detector. The capture gamma rays emitted from each sample were measured with an anti-Compton NaI(Tl) spectrometer at an angle of 125 degrees with respect to the proton beam direction. The signals from the spectrometer were recorded event by event as two dimensional data of TOF and Pulse Height (PH). Pd samples had chemical purities higher than 99.97% and isotopic purities higher than 93%. The capture yields were obtained by applying a pulse-height weighting technique to the observed net capture gamma-ray pulse-height spectra. The capture cross sections of ^{104,105,106,108,110}Pd were derived with errors less than 7%, using the standard capture cross sections of ^{197}Au. Comparing the previous results with the present results, previous results are larger than the present results by 5-60% in the region from 15 to 100 keV and at 550 keV. The capture gamma-ray spectra of ^{104,105,106,108,110}Pd were also derived by unfolding the observed capture gamma-ray pulse-height spectra for the first time.

Measurements of the neutron capture cross sections of ^{107}Pd were carried out at the Materials and Life Science Experimental Facility (MLF) of the Japan Proton Accelerator Research Complex (J-PARC). Neutrons with a repetition rate of 25 Hz were produced from the spallation reaction induced by a 3-GeV proton beam impinging on a mercury target of MLF. The proton beam power on the spallation target was 120 kW. The produced neutrons were moderated in a liquid hydrogen moderator cooled at 19 K. The sample was placed at the sample position of the downstream experimental area of the Accurate Neutron-Nucleus Reaction Measurement Instrument (ANNRI). Gamma rays from the sample were detected with an NaI(Tl) spectrometer of ANNRI. The detection angle was 90 degrees with respect to the neutron beam. The TOF and the pulse width of each event were recorded event-by-event in a list-data format file. The pulse width was converted to the pulse height using a conversion curve determined from calibration experiments. The neutron capture cross sections of ^{107}Pd were derived by dividing the background-subtracted ^{107}Pd TOF spectrum by the incident neutron spectrum in the neutron energy region from the thermal to 400 keV. In the thermal and keV energy region, previous measurements and evaluations of JENDL-4.0 and ENDF/B-VII.1 are smaller than the present results by about 30%.

Moreover, theoretical calculations were performed by using the CCONE computer code in order to obtain neutron capture cross sections of Pd isotopes in the wide neutron energy range. The capture cross sections and capture gamma-ray spectra of ^{104,105,106,108,110}Pd were calculated to reproduce the present experimental results for both the capture cross sections and capture gamma-ray spectra. The calculated capture cross sections and gamma-ray spectra of ^{104,105,106,108}Pd were in good agreement with the present experimental results, although there was discrepancy by about 30% between the calculated and measured results of ^{110}Pd at 550 keV. Furthermore, the capture cross sections of ^{107}Pd were calculated referring to the input parameters for the Pd stable isotopes. The calculated results were smaller than the present experimental results by about 30%.

This discrepancy indicates the difficulty of input parameter determination for ^{107}Pd based on the input parameters for the stable Pd isotopes.

To summarize this study, the capture cross sections and capture gamma-ray spectra of ^{107}Pd and the stable Pd isotopes generated in fission reactors were measured with high accuracy. Moreover, reliable cross section data for the stable Pd isotopes were obtained by theoretical calculations. The present study will contribute to the improvement of the accuracy of nuclear data library.

備考 ： 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).