Cross section for the $^{186,187,189}Os(n,\gamma)$ reaction at the cold neutron energy

T. Ohta[a], M. Segawa[a], Y. Temma[a], Y. Nagai[a], M. Ohshima[b], A. Kimura[b], T. Ohsaki[c]

[a] *Research Center for Nuclear Physics RCNP, Osaka, Japan*
[b] *Japan Atomic Energy Agency, JAEA, Japan*
[c] *Tokyo Institute of Tecnology, Tokyo, Japan*

Cross sections for the $^{186,187,189}Os(n,\gamma)$ reactions at cold neutron energy were measured in connection with $^{187}Re/^{187}Os$ nucleochronometer[1] at JRR-3 in JAEA(Japan Atomic Energy Agency). Cold neutrons were obtained by cooling neutrons from reactor with liquid hydrogen. γ-ray spectrum from the reactions were measured with anti-Compton Ge spectrometer with energy resolution(FWHM) of 2.0keV at 1MeV and 6keV at 7MeV. The γ-ray detection efficiency was 20% at 1332keV. We used highly enriched Os samples: $^{186}Os(n,\gamma)(99.55\%)$, $^{187}Os(n,\gamma)(99.4\%)$ and $^{189}Os(n,\gamma)(99.08\%)$. A γ-ray spectrum following the $^{186}Os(n,\gamma)$ reaction is shown Figure1

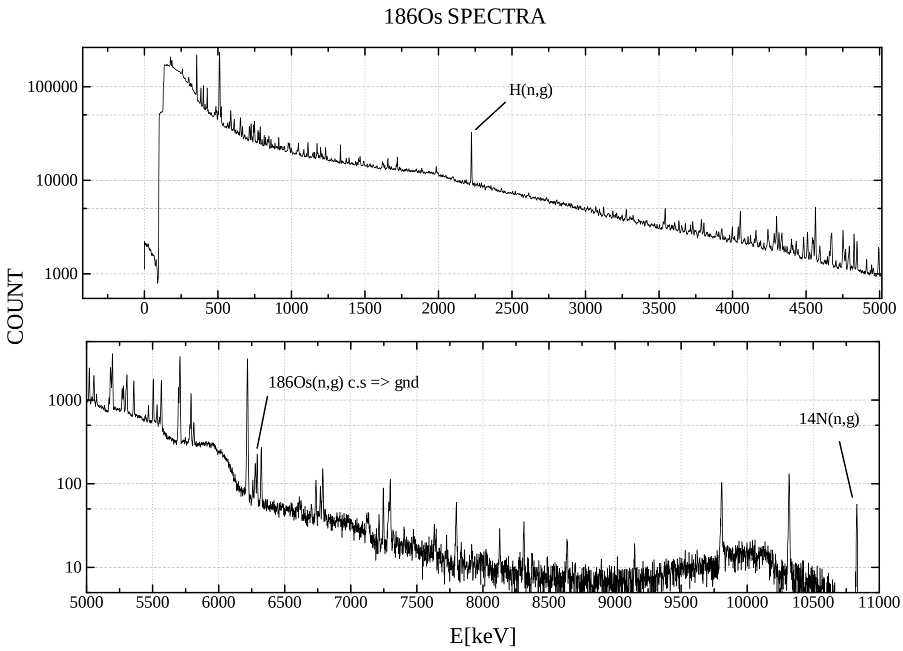

Figure 1: γ-ray spectrum following $^{186}Os(n,\gamma)$reaction

More than 400 γ-ray lines were observed including full energy, single escape and double escape peaks, and background. We show obtained γ-ray strength for the neutron capture reactions on ^{186}Os, ^{187}Os, and ^{189}Os in Figures. 2, 3, and 4, respectively together with those of previous ones[2][3][4]. The data obtained from NNDC(National Nucler Data Centar).Here, in these Figures, the highest energy of γ-rays is c.s$\rightarrow$g.s. , and these energy is 6292.6keV for ^{186}Os, for 7889.3keV ^{187}Os, and 7791.6keV for ^{189}Os, respectively.

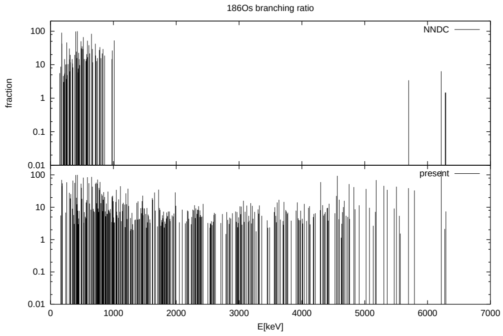

Figure 2: γ-ray strength of $^{186}Os(n,\gamma)$

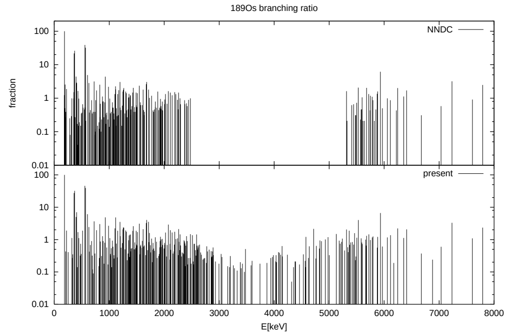

Figure 3: γ-ray strength of $^{189}Os(n,\gamma)$

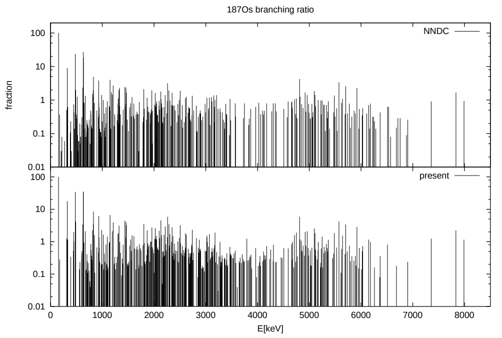

Figure 4: γ-ray strength of $^{187}Os(n,\gamma)$

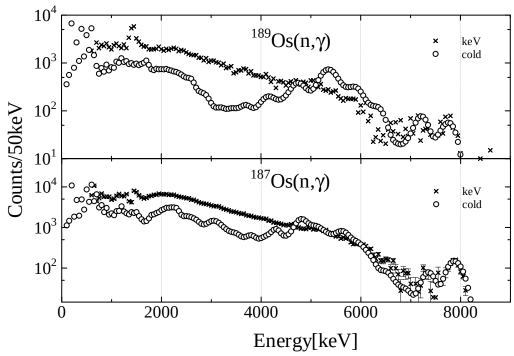

Figure 5: compare cold to keV

We could assign 303 γ-rays for ^{186}Os, 384 for ^{187}Os, and 289 for ^{189}Os, respectively. For ^{187}Os and ^{189}Os, difference from comparison between this work and past experiment can't be seen remarkable sign. While for ^{186}Os, in high-energy and low-energy γ-ray strength can be seen differene. Especially 6217.8 keV line up this work with past experiment, but it is 21.3 times greater than past experiment at γ-ray strength. In oder to study the γ-ray decay pattern from the neutron capture by Os samples to low-lying states, we compared the γ-ray spectrum thus obtained with that by the keV neutron capture reactions for Os samples taken with a NaI(Tl) spectrometer, which is shown Figure5. Here, the γ-ray spectrum taken by a NaI(Tl) spectrometer for cold neutron was obtained usingg the spectrum taken by the Ge detector with use of a response function of the NaI(Tl) spectrometer. We clearly see a difference between cold neutron energy spectra and keV neutron energy one. Further analyes including their cross sections are progress.

References

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