

## Nuclear Data Evaluation of Se Isotopes and its Application to Se-79 Capture Cross Section/Se 同位体 核データ評価及び Se-79 捕獲断面積への応用

Thursday, 20 November 2025 16:45 (1h 25m)

Se-79 produced during the operation of nuclear reactors needs to be disposed with transmutation technology due to its high radioactivity and geological migration. For developing reasonable transmutation scheme, it is important to improve the accuracy of Se-79 neutron capture cross section. Despite its importance, there is still almost no experimental data available for capture cross section evaluation. This is because the cumulative fission yield of Se-79 is very low which makes it difficult to gain enough amount of sample for data measurement. As an alternative method, the capture cross sections of stable isotopes such as Se-77, 78, and 80 can be applied for the evaluation. Their similar systematics to that of Se-79 make parameters suitable for use in estimating the Se-79 capture cross section. The present research aims to improve the reliability of Se isotopes' capture cross sections, so they become applicable for Se-79 data evaluation.

For evaluation, nuclear reaction model code system CCONE[1] was used. The optical potentials were evaluated so they reproduce the experimental total cross section data of both elemental Se and stable Se isotopes. For evaluating data below 20 [MeV], the compound reaction calculation was done based on Hauser-Feshbach statistical model. The level densities were improved from the previous work of JENDL-5 (2021)[2] by fitting to the average level spacings of s-wave neutron resonances least affected by the lack of measured resonances. The modified Lorentzian model type 1 (MLO1)[3] was chosen for E1 gamma-ray strength functions, since they align better with the experimental capture reaction data than GLO model used in the previous evaluation. In addition to the default giant dipole resonance parameters, the transition strengths from the capture state to the discrete levels were adjusted to achieve the best reproduction of capture gamma-ray spectrum derived by Igashira et al.[4].

The results for Se-77, 78, and 80 capture gamma-ray spectrum showed better fit with the experimental data than that of JENDL-5. The capture cross sections for Se-77, 78 and 80 derived from improved level densities and gamma-ray strength functions reproduced the experimental data within 26% range. Since the precision is better than JENDL-5, it is concluded that the reliability of the capture cross sections has improved. Furthermore, the Se-79 capture cross section was calculated using the systematics of the improved parameters. The result was 20% smaller than JENDL-5. The preliminary result predicts lower transmutation rate in keV to MeV region than the value predicted from JENDL-5.

### References

- [1] O. Iwamoto et al., "The CCONE Code System and its Application to Nuclear Data Evaluation for Fission and Other Reactions", NDS, 131, 259-288 (2016)
- [2] S. Kamada et al., "Calculation of Neutron Nuclear Data on Selenium Isotopes for JENDL-4", J. Nucl. Sci. Technol. 47(4), 329-339 (2010)
- [3] V.A. Plujko et al., "Testing and Improvements of Gamma-Ray Strength Functions for Nuclear Model Calculations", J. Nucl. Sci. Technol. Suppl. 2, 811 (2002)
- [4] M. Igashira et al., "Systematic Study on keV-neutron Capture Reaction of Se Isotopes", J. Korean Phys. Soc. 59(2), 1665-1669 (2011)

**Primary author:** FUNASAKA/舟坂, Yuzuka/柚香 (Waseda University/早稲田大学)

**Co-authors:** YAMAJI/山路, Akifumi/哲史 (Waseda University/早稲田大学); FUKAHORI/深堀, Tokio/智生 (Waseda University/早稲田大学); IWAMOTO/岩本, Nobuyuki/信之 (Waseda University/早稲田大学)

**Presenter:** FUNASAKA/舟坂, Yuzuka/柚香 (Waseda University/早稲田大学)

**Session Classification:** Poster Session / ポスターセッション