

Evaluation of Nuclear Decay Data to Revise ENSDF and Verification of JENDL-5 Decay Data File for Burnup Calculation/ENSDF の更新に向けた崩壊データの評価と燃焼計算のための JENDL-5 Decay Data File の検証

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To calculate reliably and accurately concentrations and activities for nuclides generated or depleted by fission and radioactive decay in nuclear fuel, it is necessary to use the updated nuclear decay data such as half-lives, branching ratios, and γ -ray spectra. The Evaluated Nuclear Structure Data File (ENSDF) contains required decay data for all nuclides, which is periodically revised by evaluating all available experimental data. However, the latest revision of ENSDF was more than 10 years ago for many nuclides, and the evaluated data for them are old. Therefore, we are performing new evaluations of decay data for these nuclides. This presentation gives a few examples of our evaluation and compares the newly evaluated values and those in the present ENSDF.

An example is the β -decay half-life of ^{129}I , which is crucial nuclear data for managing nuclear waste because this nuclide is one of the long-lived fission products. We carefully read the references that have reported the half-life measurements of ^{129}I so far to determine whether their values can be adopted. Also, a statistical analysis, such as the χ^2 -test, was conducted on these values. After these procedures, we have determined that the value in the latest reference, $1.614(12) \times 10^7$ y, should be the recommended value rather than the average, including other older values. The present ENSDF value, revised in 2014, is $1.57(4) \times 10^7$ y.

JENDL-5 Decay Data File (DDF) is one of the sub-libraries of JENDL-5 and was publicized in 2021. Most of the data in JENDL-5 DDF were taken from ENSDF. We verified the values in JENDL-5 DDF by using our newly evaluated values. For example, the half-life of ^{129}I in JENDL-5 DDF is $1.5711 \times 10^7 \text{ y} \pm 4.0027 \times 10^5 \text{ y}$. This uncertainty is considerably larger than that of the newly evaluated value. Regarding the Q-values of β -decay, our evaluation takes the values from the latest atomic mass evaluation AME2020 [1], while JENDL-5 DDF adopted the values from the former version, AME2016. The Q-value for each nuclide, especially for shorter half-lived ones, is slightly different between versions of AME.

References

[1] M. Wang et al. "The AME2020 atomic mass evaluation (II). Tables, graphs and references", Chin. Phys. C45, 030003 (2021).

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