

お知らせ (そのII)

NNDENへの投稿

Contribution to Neutron Nuclear Data Evaluation Newsletter-23

Japanese Nuclear Data Committee
(Nuclear Data Center, JAERI)

Work recently completed and publication :

- i) Evaluation of Neutron Cross Section of 27 Fission Product Nuclides Important for Fast Reactor

S. Iijima, T. Nakagawa, Y. Kikuchi, M. Kawai, H. Matsunobu,
K. Maki and S. Igarasi,

J. Nucl. Sci. Tech. 14, 161 (1977)

Results of evaluation of neutron cross sections are presented for 27 fission product nuclides selected as being most important for fast reactor calculation. The cross sections considered are total, elastic scattering, inelastic scattering and capture cross sections in the energy range from thermal to 15 MeV. Thermal and resonance cross sections were calculated from resonance parameters. The calculated thermal capture cross section was adjusted by the measured value by adding a background cross section of $1/v$ form. A modified multi-level Breit-Wigner formula was developed to avoid the well-known occurrence of negative values in elastic scattering cross section. Smooth cross sections above resonance region were calculated with the spherical optical model and the statistical theory, taking account of neutron width fluctuation and level interference. The calculation was adjusted by capture data when available. The joining between the resonance and smooth cross sections was performed with the aid of statistical examination using Monte Carlo method. Present results are discussed in comparison with other evaluated data sets. Numerical results are stored on magnetic tape in the ENDF/B format.

- ii) Evaluation of Neutron Cross Sections of Plutonium-241

Y. Kikuchi, J. Nucl. Sci. Tech. 14, 467 (1977)

The neutron cross sections of ^{241}Pu were evaluated in the energy range between 10^{-5} eV and 15 MeV, and are stored in the Japanese Evaluated Nuclear Data Library Version-1 (JENDL-1). In the energy range below 100 eV, the evaluated data contained in ENDF/B-IV and the resonance parameters recommended in BNL-325 were tentatively adopted. The unresolved resonance parameters were determined between

100 eV and 21.5 keV so as to reproduce the experimental data of the fission and capture cross sections. Above 21.5 keV, the fission cross section was evaluated on the basis of the experimental data, most of which were reported as the ratio to the fission cross section of ^{235}U and then were normalized by the fission cross section of ^{235}U adopted in JENDL-1. The capture cross section was obtained from the experimental data of α in the energy range up to 250 keV. The capture cross section above 250 keV and the elastic and inelastic scattering, $(n,2n)$ and $(n,3n)$ reaction cross sections above 21.5 keV were obtained on the basis of the theoretical calculations. The calculated cross sections are connected smoothly with those obtained from the unresolved resonance parameters at 21.5 keV. This suggests the self-consistency of the present evaluations.

iii) Neutron Cross Sections of ^6Li

S. Komoda and S. Igarasi, JAERI-M 7148 (1977)

(reported in Japanese)

Experimental data of the (n,α) reaction and the elastic scattering cross sections of ^6Li are surveyed below 20 MeV, and the reliability of the data is investigated. Estimations of energies, spins, parities, and widths for the excited levels of ^7Li are made by fitting the cross-section formula of Kapur-Peierls to the reliable data. Five even-parity levels are assumed in order to reproduce both the $1/v$ cross section at low energy and the smooth cross section in the MeV region of the (n,α) reaction consistently, and three odd-parity levels the broad peak of the elastic scattering cross section in the energy range 2-5 MeV. The calculated values of the cross sections are compared with the existing evaluated data.

iv) Evaluation of Neutron Nuclear Data for ^{243}Am

S. Igarasi and T. Nakagawa, JAERI-M 7174 (1977)

(reported in Japanese)

Evaluation of neutron nuclear data for ^{243}Am was performed below 16 MeV. Energy region above 250 eV was separated from the lower region where the resonance parameters were given. Evaluation was made to select the resonance parameters, and the thermal values of the capture and fission cross sections were obtained from the resonance parameters thus adopted. Average fission width was assumed so as to bridge the cross sections at 0.0253 eV and above 250 eV. Using a semi-empirical formula, the fission cross section was reproduced above 250 eV region. Optical and statistical model calculations were made in order to obtain

the total, capture, inelastic and elastic scattering, and (n,2n) reaction cross sections.

- v) Evaluation of Neutron Nuclear Data for ^{244}Cm
S. Igarasi and T. Nakagawa, JAERI-M 7175 (1977)
(reported in Japanese)

Evaluation of neutron nuclear data for ^{244}Cm was performed below 16 MeV. Energy region above 1000 eV was separated from the lower region where the resonance parameters were given. Evaluation was made to select the resonance parameters, and the thermal values of the capture and fission cross sections were obtained from the resonance parameters thus adopted. Using a semi-empirical formula, the fission cross section was reproduced above 1000 eV region. Optical and statistical model calculations were made in order to obtain the total, capture, inelastic and elastic scattering, and (n,2n) reaction cross sections. Number of neutrons per neutron induced fission was estimated from an empirical formula.

- vi) Evaluation of Neutron Cross Sections for ^{19}F in the Energy Range from 100 keV to 20 MeV
T. Sugi and K. Nishimura, JAERI-M 7253 (1977)
(reported in Japanese)

Fast neutron cross sections of ^{19}F were evaluated on the total, (n,n), (n,n'), (n,2n), (n, α), (n,p), (n,d), (n,t), (n, α n'), (n,n' α), (n,pn'), (n,n'p), and (n, γ) reactions. Evaluated cross-section curves are presented in graphs together with the experimental data, and evaluated cross-section data are given in tables.

Work in progress :

- i) Further calculation on ^6Li neutron cross sections is now in progress. Angular distributions of the (n, α) and elastic scattering cross sections, and the excitation functions of inelastic scattering, (n, α) reactions, elastic scattering and total cross sections are expected to be obtained simultaneously. (from S. Igarasi, JAERI)
- ii) Preliminary results of the nuclear data evaluation for ^{235}U , ^{238}U , ^{239}Pu , ^{240}Pu , and ^{241}Pu were recently published in JAERI-M 6996. However, mutual consistency of the evaluated data among the above five nuclides is not completely satisfied in this evaluation, because the works were almost independently performed by five evaluators.

In order to remove this defect, reevaluation work for the above five nuclides has been commenced as a part of the works in Working Group on Heavy-Nuclide Nuclear Data of JNDC. (from H. Matsunobu, SAEI)

- iii) Evaluation for about 70 fission product nuclides is now in progress by a working group of the JNDC. A part of this evaluation work has been contributed to the Second IAEA Advisory Group Meeting on FPND, Held at Petten, Sept. 1977. (from S. Iijima, NAIG)

Work planned for the near future :

The second version of Japanese Evaluated Nuclear Data Library, JENDL-2, is going to be released at April 1980. In this context, many new works on the evaluation including reevaluation on the JENDL-1 are planned. (from T. Fuketa, JAERI)

Work about codes :

A code named FISCAL is now being developed, which calculates the fission cross section on the basis of the statistical model. The fission transmission coefficients are obtained by means of the channel theory on the double-humped fission potential.

(from Y. Kikuchi, JAERI)

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October 10, 1977