Status of Fission Products Evaluation in KAERI

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1. Introduction

The evaluation work was motivated by the need to improve ENDF/B-VI for materials of importance for a number of applications, such as criticality calculations for spent fuel storage design, high burn-up fuel design and reactor core design. Based on such applications, 19 fission product nuclei were selected and evaluated on Mo-95, Tc-99, Ru-101, Rh-103, Pd-105, Ag-109, Xe-131, Cs-133, Pr-141, Nd-143, Nd-145, Sm-147, Sm-149, Sm-150, Sm-151, Sm-152, Eu-153, Gd-155 and Gd-157. It has been performed under the KAERI-BNL joint collaboration work.

2. Models

The fast energy calculation was done using the several models: spherical and deformed optical model, MSC and MSD, pre-equilibrium exiton and Hauser-Feshbach with width fluctuation[1]. The calculated cross sections are graphically compared with the experimental data and the evaluated files (ENDF/B-VI, JENDL-3.2, JEF-2.2, BROND-2 and CENDL-2). The direct and semi-direct capture model was recently introduced to increase the accuracy of the pre-equilibrium capture cross section.

3. Evaluation

The fast energy region evaluation results were merged with the evaluated resonance part in the unresolved energy[2]. The final nuclear data set involves (n, tot), (n, n), (n, n'), (n, 2n), (n, 3n), (n, nα), (n, np), (n, γ), (n, p) and (n, α) cross sections from thermal to 20 MeV. Fig. 1 and 2 show the capture cross section for Ag-109 and Gd-155. All results were converted into the ENDF-6 format and several codes, CHENKR, FIZCON and PSYCHE, were applied to check the final files. The process checking using NJOY[3] was successfully done. The files are in the preliminary stage at ENDF/B-VII.

References

[1] M. Herman, EMPIRE-II: Statistical Model Code for Nuclear Reaction Calculations, Vienna, IAEA.
[2] S.Y. Oh and J.H. Chang, Neutron Cross Section Evaluations of Fission Products below the Fast Energy Region, BNL-NCS-67469 (KAERI/TR-1511/2000), Brookhaven National Laboratory.
[3] R.E. MacFarlane, D.W. Muir, "The NJOY Nuclear Data Processing System, Version 91," LA-12740-M, Oct., 1994.
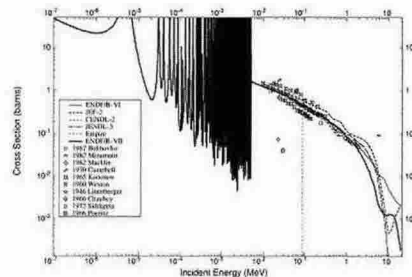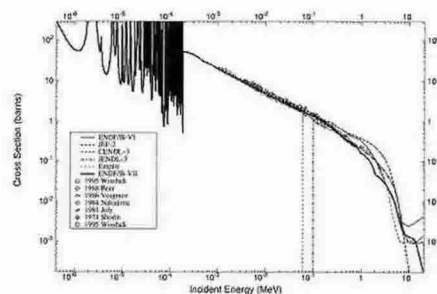
Fig. 1. Capture cross section of Ag-109.

Fig. 2. Capture cross section of Gd-155.