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The Present Status of CENDL−2.1

Liu Tingjin

(China Nuclear Data Center, CIAE, China)

Since last Meeting of NEA WP on International Evaluation Cooperation in May, 1995, the efforts in China have been made to supplement, test and improve CENDL−2.1 and develop CENDL−3.

1 The Supplement and Improvement of CENDL−2.1

As one of the main problems of CENDL−2.1, the data of natural Fe are not consistent with the data of its isotopes. Inconsistence between natural element's and its isotopes' data is one of the main problems existing in current major evaluated nuclear data libraries. A method and program system CABEI have been developed[1] for adjusting the consistence between natural element and its isotopes data, and at the same time, keeping the data themselves consistence for each nuclide, that is, total cross section equals the sum of elastic and nonelastic cross section, nonelastic cross section equals the sum of all nonelastic channel cross sections, and inelastic cross section equals the sum of all cross sections of inelastic scattering to discrete and continuous states. Using the system, Fe data were adjusted, and as a result, the data became consistent. It was found that the data are changed little in the energy region, where they are originally basically consistent, and large in the region, where they are originally discrepant. In Figs. 1 and 2, as examples, are shown a part of the total cross section and nonelastic cross section of natural Fe.

Some problems on the energy balance have been found for the data calculated with program UNF[2]. The program has been improved, and using the new version, the data of some intermediate weight nuclides, such as Cl, Hg, Tl etc., were newly calculated.

Taking into account of the enlightening of the macroscopic test, the ^{238}U data, especially inelastic scattering cross section, have been improved[3].

The data of nuclides $^{0,50,52,53,54}Cr$, $^{0,54,57,58}Fe$, $^{0,63,65}Cu$, ^{27}Al, ^{55}Mn, ^{93}Nb, which were evaluated by Chinese scientist under cooperation with Japanese scientists for JENDL−3 fusion file and adopted in CENDL−2.1, were checked and corrected little[4].

The present status of CENDL−2.1 is summarized in table 1.

Table 1 CENDL−2.1

	Total nuclide	MF6	MF12−15	MF31−33
CENDL−2.1	68	25	38	10
CENDL−2	54	4	14	7

The intercomparison of main structure materials Fe, Cr, Ni data of CENDL−2.1 with major evaluated nuclear data libraries ENDF / B−6, JENDL−3.2, JEF−2 and BROND−2 is underway, the reason of the secondary γ spectrum discrepancy is been studying. Some progress have been made on establishing and improving Chinese Evaluated Nuclear Parameter Library (CENPL)[5].

2 Benchmark Test of CENDL−2.1

CENDL−2.1 has been tested for ten homogeneous, eight heterogeneous thermal[6] and nine homogeneous fast assemblies[7], which were recommended by CSEWG of America. 123 group (for thermal) and 175 group (for fast) cross section were generated with code system NJOY91.91 / NSLINK, the effective multiplication factors and reaction rate ratios were calculated with code system PASC−1.

The calculated K_{eff} are shown in Figs. 3, 4 for ~~homogeneous and~~ heterogeneous thermal assemblies. It can be seen that the K_{eff} are much close to 1.0 for first five homogeneous ~~(Fig.3)~~ and eight heterogeneous (Fig. 4) uranium assemblies, ranging from 0.9944 to 0.9995 and from 0.9965 to 1.0027 respectively, but are considerably overestimated (maximum 2.44%) for last five homogeneous plutonium assemblies ~~(Fig. 3)~~. In Fig. 5, the K_{eff} are shown for homogeneous fast assemblies. It can be seen that they are very close to 1.0 (ranging from 0.9994 to 1.0014) for first three ^{235}U assemblies with different spectra. They are overestimated by about 0.4% for two plutonium metal bare sphere assemblies (JEZEBEL and JEZEBEL−Pu), but it becomes better for plutonium assembly with natural uranium reflector (FLATTOP−Pu). They are changed from 0.9946 to 1.0093 for three different ^{233}U assemblies without, with natural U and ^{232}Th reflector.

In conclusion, the agreements of the calculated K_{eff} with experimental ones are quite well for U fast, thermal (homogeneous and heterogeneous) assemblies, but the K_{eff} are overestimated for Pu thermal, fast assemblies. This means that the data of ^{235}U, ^{238}U, O and H in CENDL-2.1 are reliable, but the data of ^{239}Pu need to be improved. The similar conclusion also obtained from analysing the calculated reaction rate ratio data for above assemblies[6, 7].

To compare, also the calculations have been done with ENDF / B-6 data for above assemblies and the K_{eff} are also shown in Figs. 3-5.

3 CENDL-3

A five year plan (1996-2000) for nuclear data have been examined and approved by the First Plenary Session of the Second Nuclear Data Committee of China, held in Beijing in May, 1995. To make the plan in detail and workable, follow after, the joint meeting of Chinese Nuclear Data Evaluation and Nuclear Theory Working Group and the meeting of Chinese Nuclear Data Measurement Working Group were held in Oct. and Dec., 1995 respectively.

According to the plan, CENDL-3 will be completed by 2000, and will contain 200 nuclides. Among them, the data of following nuclides will be newly or reevaluated : fissile nuclides 15, structure materials 18, light nuclides 7, fission products 91. It will contain consistent data between natural elements and their isotopes for structure material, newly evaluated data for fission products, and more γ-production data (files 12-15), double differential cross sections (file 6), covariance data (files 31-35).

According to the plan, also the special files for fission yield, activation cross section, decay data and intermediate energy data will be developed. An expert system for nuclear data evaluation will be established. CENPL will be improved and revised.

To complete the plan, many groups on different subjects have been organized at CNDC and in China Nuclear Data Network, and a detail plan for 1996 has been made. The works are underway smoothly.

References

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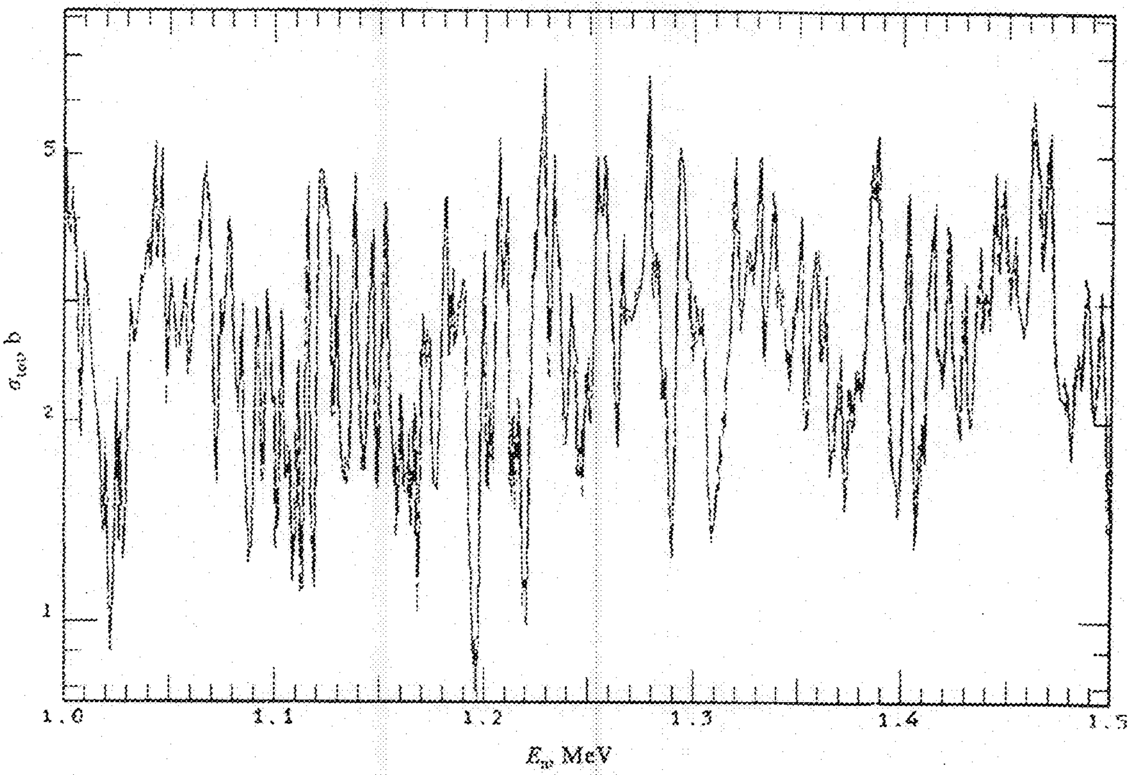

Fig. 1 Fe total cross section

—— adjusted; – – original

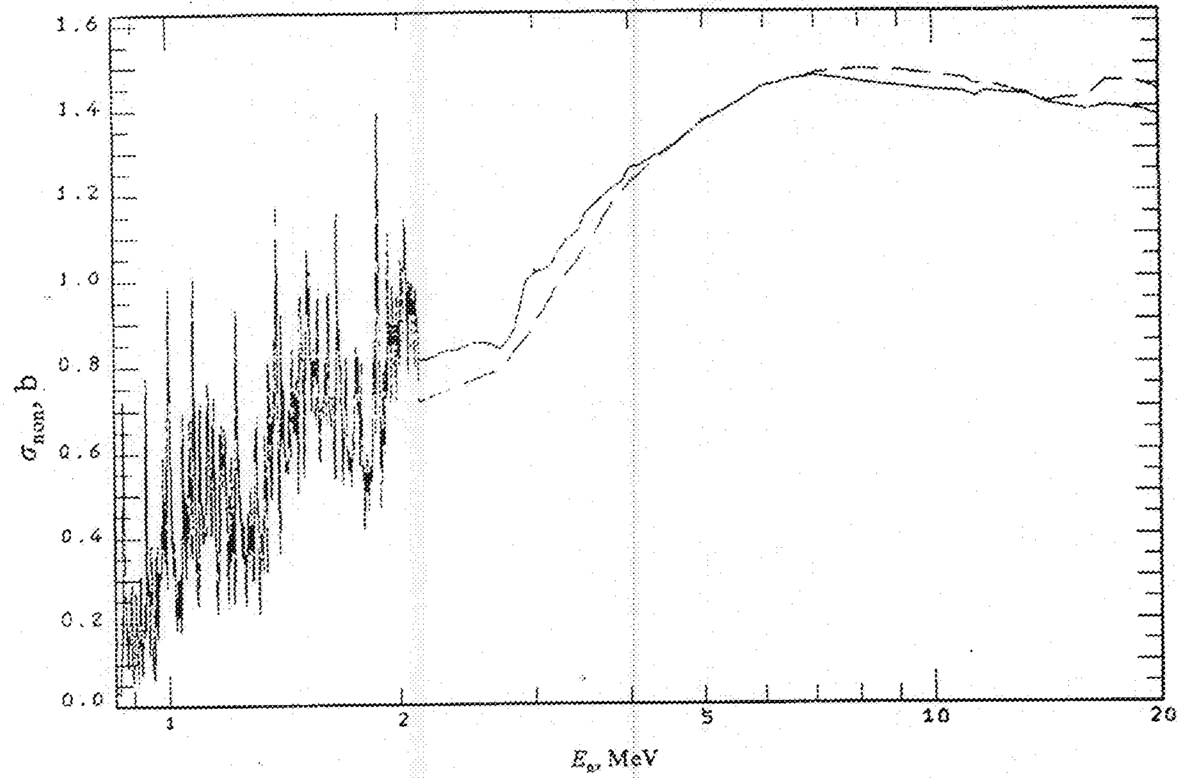

Fig. 2 Fe nonelastic cross section

—— adjusted; – – original

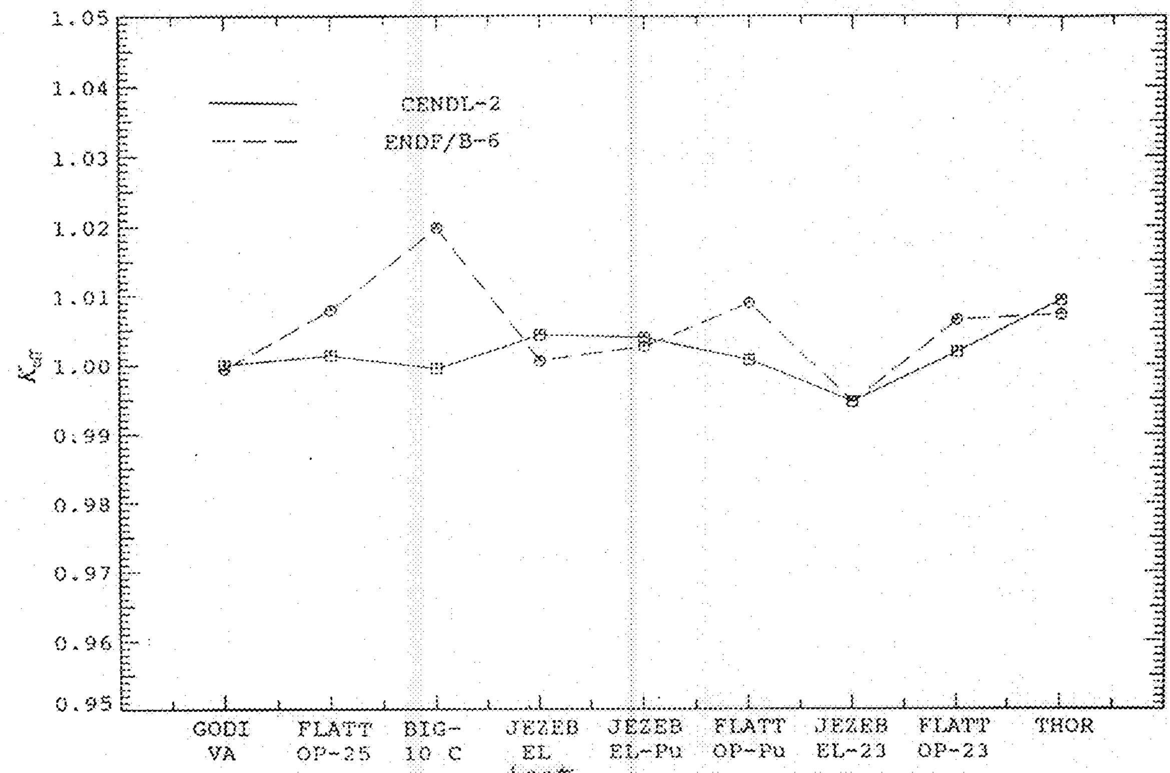

Fig. 3 K_{eff} for ~~thermal~~ fast homogeneous assemblies

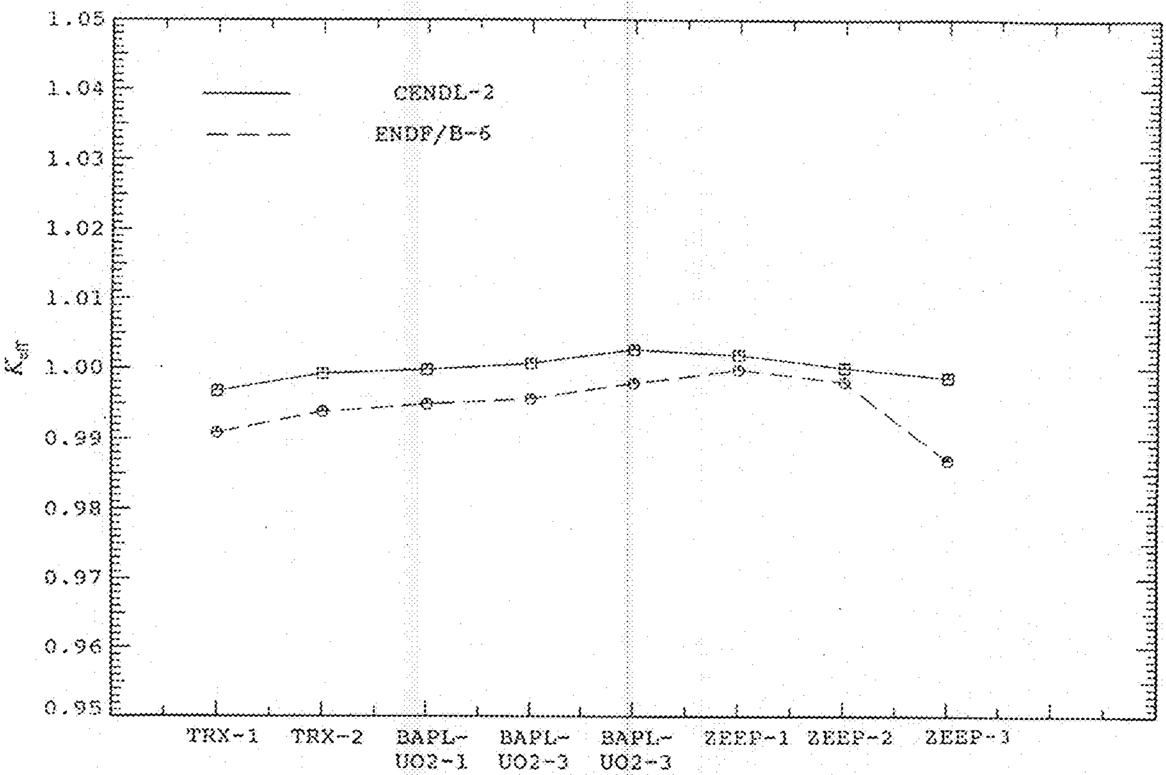

Fig. 4 K_{eff} for thermal heterogeneous assemblies