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WIMS-IJSO - An Extended Version of the WIMS Group Constant Library

A. Trkov, A. Perdan
J. Stefan Institute, E. Kardelj University of Ljubljana
Yugoslavia

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1. Introduction

WIMS-IJSØ is a preliminary extended version of the WIMS library[1] as supplied with the CDC version of the S-WIMS-code[2]. It is a result of the feasibility study of the possibility to update and extend the WIMS library. In the course of its preparation valuable experience was gained in understanding the definitions, the conventions and the structure of the WIMS library. This experience will be used in the preparation of an extended WIMS library for some materials from carefully chosen evaluated data. The library as supplied with the WIMS-D4 package[3] will be used as the basis.

The materials added to the library had been tested in reactor calculations[4,5] and their performance was found to be satisfactory.

The aim of releasing the preliminary version of the WIMS library is to allow different users to apply the data to various problems. From their experience we want to learn about any deficiencies of the data and to receive suggestions of how to improve the library and what other materials to include.

2. Procedures

2.1. Processing programs

FEDGROUP group constants library is used as the source of group constants data. It is generated by FEDGROUP-C package[6] from any evaluated library in ENDF/B, UKNDL or KEDAK format. The package is an improved and modified version of FEDGROUP-2[7] and it is available with all the required auxilliary programs for post-processing the data including the program FEDWIM- the FEDGROUP-WIMS interface. In the thermal region FLANGE-AE is used[8].

The FLANGE-AE results were converted into FEDGROUP format using program FLACOF which is also part of the auxilliary program library supplied with FEDGROUP-C.

2.2. Alterations to the WIMS library

To reduce the length of the library certain materials which were considered redundant were deleted from the library. They are listed in Table I.

Table I: Materials deleted from the original WIMS library

Material number	Description
4001	Hydrogen (Haywodd model)
4002	Deuterium (Honeck model)
5002	Deuterium (Honeck model)
8002	Deuterium (effective width model)
9002	Deuterium (effective width model)
1010	Boron 10 - unburnable
1011	Natural boron (pure 1/v below 100 keV)
232	Thorium 232
1232	Thorium 232
233	Uranium 233
238	Uranium 238
1238	Uranium 238
239	Plutonium 239
1239	Plutonium 239
2239	Plutonium 239
240	Plutonium 241

All the recommended materials are reteined in the library and are accessible.

Following is the description of the materials that were added to the library.

Material 3001: hydrogen bound in water

ENDF/B-IV, MAT 1269 from general prupose library[9] and ENDF/B-III, MAT 1002 from Thermal scattering data library[10]

were used to prepare the group constants. The data for hydrogen are the best available from ENDF/B files as there were no reported changes in the cross-section values in the ENDF/B-V files (which is also available in the standards file[11]) and the thermal data file is still recommended for use. Thermal data were calculated at 296, 450, 600 and 700 K. Note however that there exists an unresolved discrepancy in the transport cross-section in the fast region between the calculated data and those in the original WIMS library. The B_1 flux solution option should therefore be used in WIMS.

Material 1241: plutonium 241

ENDF/B-IV, MAT 1266 from general purpose library was used to prepare the group constants. No temperature dependence in the thermal region was considered. Free gas approximation was assumed. In the resonance region the resonance integral tables at 300 and 900K were given for σ_o values of 5000, 10000 and 500000 barns and at infinite dilution. Decay and fission product formation data were the same as for material 241.

Material 1235: uranium 235

ENDF/B-V, MAT 1395 from the standards file was used. Resonance integrals were tabulated for the same values of temperatures and σ_o as for material 235. The decay and fission product formation data were also the same. In the thermal range free gas approximation at 300 K was assumed and no temperature dependence given.

Material 3238: uranium 238

ENDF/B-V, MAT 6398 from the dosimetry file was used to calculate the radiative capture and fission cross-sections and

the resonance integrals. The elastic scattering data were normalised to be consistent with the total cross section calculated from ENDF/B-IV, MAT 1262 general purpose library. In the thermal range free gas approximation at 300 K was assumed and no temperature dependence given.

Material 107: silver 107

ENDF/B-V, MAT 1371 from fission products file was used. The resonance integral data were tabulated at 300 and 600 K for σ_0 values of 15, 45, 100, 500, 5000, 50000 barns and at infinite dilution. In the thermal range no temperature dependence was considered and upscattering was ignored.

Material 1109: silver 109

ENDF/B-V, MAT 1373 from fission products file was used. The resonance integral data were tabulated for the same temperatures and σ_0 values as silver 107 (material 107). In the thermal range no temperature dependence was considered and upscattering was ignored.

Material 1112: natural cadmium

ENDF/B-IV, MAT 1281 from general purpose library was used. No resonance tables were calculated. In the thermal range no temperature dependence was considered and upscattering was ignored.

Material 1115: indium 115

ENDF/B-V, MAT 6437 from the dosimetry file was used. Due to lack of data the potential scattering was used as the

scattering cross-section. Resonance integrals were tabulated for the same temperature and σ_o values as silver 107 (material 107). In the thermal region no temperature dependence was considered and upscattering was ignored.

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