



INTERNATIONAL ATOMIC ENERGY AGENCY

NUCLEAR DATA SERVICES

DOCUMENTATION SERIES OF THE IAEA NUCLEAR DATA SECTION

IAEA-NDS-0137

Rev. 2, July 1995

ADL-3

Neutron activation data library

by O. T. Grudzevich, A. V. Zelenetskij,
A. V. Ignatyuk, A.B. Pashchenko

Summary documentation

by A.B. Pashchenko, H.D. Lemmel

Abstract: This document summarizes a neutron activation cross-section data library containing more than 20 000 excitation functions for neutron energies up to 20 Me v. The data are available from the IAEA Nuclear Data Section on magnetic tape or online via INTERNET by FTP command.

Revised by P.K.McLaughlin IAEA/NDS Jan. 2005

The file was revised to conform with ENDF/B format standards.. The merged file was corrected for format errors and processed through the code CHECKR to ensure, as far as possible, format compatibility.

Nuclear Data Section
International Atomic Energy Agency
P.O. Box 100
A-1400 Vienna
Austria

e-mail: services@iaeand.iaea.org
fax: (43-1) 26007
cable: INATOM VIENNA
telex: 1-12645
telephone: (43-1) 2600-21710
Web: <http://www-nds.iaea.org>

Note:

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Citation guidelines:

This data library should be cited as follows:

O.T. Grudzevich, A.V. Zeleneckij, A.V. Ignatjuk, A.B. Pashchenko, "ADL-3: Nuclear data library for activation and transmutation calculations", Atomnaja Energija vol. 76 (1994) p. 127-130; English translation report INDC(CCP)-386 (International Atomic Energy Agency, 1995). Data library ADL-3 received [on tape, or: online, date] from the IAEA Nuclear Data Section.

ADL-3

Neutron activation data library

1. Introduction

The Russian Activation Data Library, ADL-3, was completed and released in November 1993 from the Russian Nuclear Data Center, Obninsk. The library contains 20049 excitation functions of reactions on stable and unstable (isomeric) targets. Cross-sections for all threshold reactions were calculated by statistical theory of nuclear reactions in the framework of Hauser-Feshbach formalism with taking into account the contribution of non-statistical mechanism. Experimental data and systematics were used for normalization.

2. References

The index of reactions included and a brief introduction is contained in the Russian scientific journal: *Voprosy Atomnoi Nauki i Techniki*, Ser.: *Yadernye Konstanty*, Issue 3-4, 1993 (in Russian).

The generation of the data library is described in a journal article, O. T. Grudzevich, A. V. Zeleneckij, A. V. Ignatjuk, A.B. Pashchenko, "ADL-3: Nuclear data library for activation and transmutation calculations", *Atomnaja Energija* vol. 76 (1994) p. 127-130; English translation report INDC(CCP)-386 {International Atomic Energy Agency, 1995}.

3. Format

The format of the ADL-3 is so called 'FENDL-A I format which is essentially that of an MF-3 file of ENDF-6 format with the following deviations:

- (a) If a reaction produces isomers the cross sections for the ground- and isomer-state are given separately.
- (b) The material number MAT consists of Z and two last digits of A. To describe metastable targets A has been increased by 50, 70 or 80 (m1, m2 or m3, respectively). For example, for stable and m1 metastable target nucleus 67-Ho-166 the material numbers are MAT=6766 and MAT=6716, respectively. For stable and m2 metastable target nucleus 65-Tb-156 the material numbers are MAT=6556 and 6526 respectively. Consequently. The order of the target nuclides (according to increasing MAT numbers) is not always in accordance with the increasing Z and A.
- (c) The reaction nomenclature is that of ENDF format, except that reaction numbers leading to metastable states have been increased by 300 and 600 (for m1 and m2, respectively). In case the isomer production data are included the standard ENDF format notation for the same reaction gives cross sections for production of the ground state (not total 'm + g' but simply 'g').

The MT numbers which occur are listed below.

MT	Reaction *)	MT	Reaction
4 =	(n,n)	304 =	(n,n)* 1st isomer production
16 =	(n,2n)	316 =	(n,2n)* 1st isomer production
		616 =	(n,2n)# 2nd isomer production
17 =	(n,3n)	317 =	(n,3n)* 1st isomer production
22 =	(n,na)	322 =	(n,na)* 1st isomer production
		622 =	(n,na)# 2nd isomer production
28 =	(n,np)	328 =	(n,np)* 1st isomer production
		628 =	(n,np)# 2nd isomer production
32 =	(n,nd)		
33 =	(n,nt)		
34 =	(n,nHe3)		
102 =	(n,g)	402 =	(n,g)* 1st isomer production
		702 =	(n,g)# 2nd isomer production
103 =	(n,p)	403 =	(n,p)* 1st isomer production
		703 =	(n,p)# 2nd isomer production
104 =	(n,d)	404 =	(n,d)* 1st isomer production
		704 =	(n,d)# 2nd isomer production
105 =	(n,t)		
106 =	(n,He3)		
107 =	(n,a)	407 =	(n,a)* 1st isomer production
		707 =	(n,a)# 2nd isomer production
111 =	(n,2p)		

*) The MT numbers in the left side column identify the total cross sections of indicated reactions in case when the isomer production data are not included, or the ground state production cross sections in case of residual nuclides with isomer(s).

The cross sections for one material number are ordered according to increasing MT numbers.

4. Availability

The files are available from the IAEA Nuclear Data Section online through INTERNET. The file transfer via INTERNET can be performed by FIP command to the address:

**IAEAND.IAEA.OR. AT
or 161.5.2.2**

The user should logon with the user name 'NDSOPEN' .No password is required.
After having logged on the user should go to the subdirectory

'[ADL3T]'

to see index of reactions included in ADL3T .INDEX file and to obtain the available data files.

See AAREADME. TXT file for further information.

The ADL-3rr data library is a huge file (-33 Mb) and for this reason it was split into 9 data sub files of a convenient size adequate for FfP transfer:

ADL3T .001
ADL3T .002
ADL3T .003
ADL3T .004
ADL3T .005
ADL3T .006
ADL3T .007
ADL3T .008
ADL3T .009

5. List of reactions

The ADL3T .INDEX file provides a complete list (catalogue) of content of the library. Each excitation function of the library is allotted one line in the ADL3T .INDEX file, which gives the following information in sequence:

- Target nucleus Z-S-A, and its state (isomeric or ground). If the nucleus is in isomeric state, the symbol 'm' for first, 'n' for second or 'k' for third isomeric state appears after the target nucleus identification;
- Type of reaction, for example (n,2n);
- State of residual nucleus. If the population of isomeric states occurs in a reaction, total cross-sections is indicated by a blank and the isomeric states are denoted as for the target nuclei. In order to reduce the catalogue's volume, lines with information on population of ground states have been omitted;
- Source of data or evaluation/calculation method. This column provides information on the library from which the cross-sections were taken, or the name of the computer code on the results of which the evaluation is based, etc.
For example, **BROND-2GRP** means that data from the **BROND-2** library have been used and the cross-section data are given in the group representation;
- Value of reaction cross-section, mb, at incident neutron energy **14.5 MeV**;
- Value of reaction cross-section, mb, at incident neutron energy **18.0 MeV**;
- Reaction energy, **MeV**;
- Self-explanatory brief comments on evaluation methods. The following notations are used:

- Em, Jm - energy and spin of the isomeric state;
- xs values of the cross-section for (n, γ) reaction at neutron energies of 0.025 eV and 30 keV, respectively. The symbols after the figures identify the type of cross-section: e - experimental, s - from systematic, c - calculated;
- RO, RI - values of isomeric ratio for $E_n = 0.025$ eV and 30 keV, respectively;
- Gg, Do - average radiative width (MeV) and average distance between neutron s-resonances (eV);
- RN EXP - the excitation function has been renormalized to the experimental value of the cross-section;
- RN DATA_t - the excitation function has been renormalized to the cross-section value shown immediately after;
- RN EVAL - the excitation function has been renormalized to the cross-section value evaluated by a specific author;
- RN SYST - the excitation function has been renormalized to the cross-section predicted by systematic;
- RN BR - evaluated/calculated data have been renormalized to the branching ratio;
- OMP - optical model parameters from global systematics Perey, Wilmore-Hodgson, Becchetti-Greenlees, McFadden, etc.