Available online at www.sciencedirect.com
ScienceDirect
Annals of Nuclear Energy 33 (2006) 1157–1158
annals of NUCLEAR ENERGY
www.elsevier.com/locate/anucene

Book review

S.F. Mughabghab, Atlas of Neutron Resonances. Resonance Parameters and Thermal Cross Sections $Z = 1$–100

This book is the latest in the series of compilations of nuclear data produced by the National Nuclear Data Center at Brookhaven National Laboratory. Dr Mughabghab has comprehensively updated his compilation of thermal cross sections and resonance parameters, previously published in two parts, as Neutron Cross Sections Volume 1, with Part A ($Z = 1$–60) (co-authored with Divadeenam and Holden) being published in 1981 and Part B ($Z = 61$–100) in 1984. These have been most valuable reference documents for evaluators producing files of cross section data for inclusion in the major libraries of nuclear data and for those requiring specific items of data. They also provide a description of the nuclear models developed to calculate these data, the performance of these methods and the insight they give concerning nuclear interactions. The methods used to derive the parameters from measurements are also described. This updated version is therefore recommended, particularly to those who have found the earlier books valuable references and also to those becoming involved with nuclear data. There is also much material here of value to those developing nuclear models.

A measure of the importance of Dr Mughabghab's evaluations can be gauged from the number of materials in the latest (preliminary) version of ENDF/B-VII which name him as one of the evaluators. These range from ^{71}Ga to ^{175}Lu. (http://www.nndc.bnl.gov/exfor2/4web/b2summary.pdf).

The book consists of a little over 100 pages of Text followed by about 1000 pages of Tables giving Thermal Cross sections, Resonance Properties and Resonance Parameters. An important feature of the Tables is that error estimates are included for almost all of the values (notable exceptions being the resonance parameters of ^{233}U, ^{235}U, ^{239}Pu, ^{240}Pu and ^{241}Pu – presumably a consequence of adopting recent evaluations of the resonance parameters for which uncertainty estimates were not available). In addition to average resonance region characteristics (mean widths and spacings, strength functions and resonance integrals) 30 keV Maxwellian average capture cross sections of interest to astro-physicists are included.

The Text section comprises three chapters describing the three types of data included in the tables: thermal; resonance region averages and integrals; and resonance parameters. These have been carried over from the earlier editions with some new sub-sections added. This section of the book includes 309 references.

The scattering length standards and the thermal cross section standards are mostly unchanged. Small revisions have been made to the oxygen scattering length, and the ^{55}Mn(n,γ) and ^{6}Li(n,α) thermal cross sections, and ^{1}H(n,γ) and ^{35}Cl(n,γ) have been added as standards. Westcott g factors given in the Text section are also unchanged. The thermal cross section values of Divadeenam and Stehn (1984) for ^{233}U, ^{235}U, ^{239}Pu and ^{241}Pu have been maintained. Compared with the previous edition there are some small modifications to the scattering cross sections and to capture in ^{235}U and ^{241}Pu. The thermal capture cross sections of ^{238}U and ^{240}Pu are also unchanged but there are changes to the scattering cross sections. However, the resonance parameters have been comprehensively revised.

The methodology of resonance parameter analysis is as described in the earlier volumes. An *R*-matrix representation is used for light nuclides and the Breit–Wigner formalism for the heavier nuclides (with some exceptions noted in the Tables, such as ^{233}U and ^{235}U for which the Reich–Moore formalism is used).

The additions to the Text part of the book include a new sub-section describing the Generalised Fermi Liquid model developed by Mughabghab and Dunford and its performance in predicting capture widths. The discussion on subthreshold fission in ^{238}U has also been extended. Nuclear data included in the Text section have also been updated (although not in all cases being the same as in the Tables).

The Tables have extensive lists of references for each material, separating the thermal and resonance region data. The references are given in inverse date order so that one can quickly see how up-to-date the data sources are. The half-life data have also been updated.

The usefulness of these very valuable Tables would be greatly enhanced if the NNDC could make available a cd-rom or dvd containing the tables in a simply structured form. (An alternative for those evaluations included in ENDF/B-VII or B-VI would be to provide information

doi:10.1016/j.anucene.2006.06.004

on this connection, although one would not then have a simple computerised access to the error estimates.) If the text part could also be included on the cd-rom it would be possible to search for particular topics. The absence of an index would not then be a problem. An alternative would be for the Tables to be available on line at the NNDC web site.

John Rowlands
81 South Court Avenue,
Dorchester, Dorset DT1 2DA,
United Kingdom
E-mail address: rowlandsjl@aol.com

Available online 22 September 2006