Book Review

Neutron Activation Tables. By Gerhard Erdtmann. Verlag Chemie, Weinheim (1976). 146 pp. $31.20.

Among the different techniques existing for the determination of traces of elements, neutron activation analysis assumes one of the most significant positions. It is widely used for solving many scientific and practical problems in different fields of research and technology. In addition, neutron activation is now, as before, the most important technique for the production of a great number of radioisotopes. In both these application fields, the ability to solve the various specific problems depends on a good knowledge of the corresponding activation data.

Several compilations and handbooks have already been published on neutron activation data. However, their critical evaluation shows the need for improving them, mainly with respect to the completeness and accuracy of the data and to their convenient presentation. From this point of view, the book under review is of undoubted interest.

Excluding a short Preface, the book consists of four parts. In the Introduction, the author gives, in only four pages, an impressive extract of the principal notions relevant for neutron activation generally and also for the use of the tables, covering neutron reactions, cross sections, effective cross sections, and neutron spectra. In the second part, also four pages long, a short and clear explanation of the organization of the data tables, the symbols used, the conditions to which the data are related, and 30 references used as sources of the nuclear data are given.

The third part, the actual tables, consists of data, which are presented in three sections for each element. The first section gives data on (n, γ) reactions for thermal and epithermal neutrons, the second for fast reactor neutrons, and the third for 14.5-MeV neutrons in (n, p), (n, α), $(n, 2n)$, and (n, n') reactions. The elements are ordered by their atomic number, and the natural isotopes of one element, within each section, by their mass number. The basic nuclear data given include half-lives of the product nuclides, data on thermal-neutron activation cross sections, resonance integrals (cadmium cutoff), fast reactor neutron average cross sections, cross sections for 14.5-MeV neutrons, the main gamma and x rays, and their absolute intensities. In addition to these nuclear data, calculated activities in disintegrations per second and per microgram of element obtained for irradiation times of 1 s, 1 min, 1 h, 1 day, and 20 days, plus the saturation activities, are listed for certain assumed values of thermal-, epithermal-, and fast-neutron flux as well as of 14.5-MeV neutron flux.

The presentation of the data is clear and practical. The author has chosen a format similar to that used in the *Table for Neutron Activation Constants* by F. Baumgärtner (1967), which proved very convenient to use. The user can estimate very easily and rapidly the activity produced in an activation with reactor neutrons. In activation analysis, for example, preliminary calculations for sensitivities, primary interference reactions, and optimization of experimental conditions can be made using the tabulated data.

For activation analytical purposes, however, it would have been of value if listings of the energetically possible primary interference reactions and data on second-order reactions had been included in the tables, since the estimation of accuracy is at least as significant as that of sensitivity and other factors.

The data source mainly used in the tables—*Handbook on Nuclear Activation Cross-Sections*, International Atomic Energy Agency, Vienna, 1974—is indeed the most recent comprehensive compilation in this field, giving recommended values based on critical analysis of the published values. However, the data choice is more than necessarily limited to this and a very few other data sources. For example, for 14.5-MeV neutrons, data are given only for (n, p), (n, α), and $(n, 2n)$ reactions, but not for other energetically possible reactions such as (n, γ), (n, t), $(n, {}^3\mathrm{He})$, (n, pn), $(n, \alpha n)$, and (n, n'), which can be, in some cases, of interest as interfering reactions or even as principal reactions, such as $^{89}\mathrm{Y}(n, n')^{89m}\mathrm{Y}$ and $^{204}\mathrm{Pb}(n, n')^{204m}\mathrm{Pb}$. Data for these reactions were available in different tabulations or original publications.

The final part, the Appendix, gives complex decay chains for all those cases where more than two radioactive species are built up as consequence of the neutron capture process. This collection is also of great practical value, as it enables calculation of the activities of the particular members that may often be of interest as indicator or interfering radionuclides.

This is a valuable and useful data tabulation for all those who use the activation with reactor and 14-MeV generator neutrons as an analytical tool or for the production of radioisotopes.

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About the Reviewer: Professor Krivan is head of the Division for Analysis and High Purification at the University of Ulm and has held appointments at the Max Planck Institute for Metals Research, at the Nuclear Research Center at Karlsruhe, and to the faculty of the Technical University of Bratislava, where he received his academic training. His research interests include the application of diverse nuclear techniques to elemental and ionic trace analyses and the measurement and critical evaluation of the requisite nuclear data. Dr. Krivan has also been a visiting professor at Texas A&M University.