Book Reviews

The New Heat Transfer. By E. F. Adiutori. The Ventuno Press, Cincinnati (1974). 240 pp. $19.95.

Written in an unconventional and sometimes argumentative manner, this book describes different and somewhat unusual approaches to the engineering science of heat transfer. Contending that the traditional concept of a heat transfer coefficient merely adds artificial complexity and confusion, the author proposes treating convective heat transfer by a fundamental equation of the form

$$q = f_1 \text{ (system properties) } f_2 \text{ (thermal driving force)} \quad , \quad (1)$$

where the f's refer to functions in a broad sense. The author further asserts that the concept of dimensional analysis is nonscientific and of little value and suggests correlating heat transfer data in the form of Eq. (1) without resorting to using dimensionless groups. The book, which consists of nine chapters, is almost entirely devoted to the consideration of convective heat transfer problems. Also included are discussions and illustrative examples on the thermal stability of heat transfer processes, pool boiling curves for both ordinary liquids and liquid metals, the application of the author's generic criterion for thermal stability to the design and analysis of thermal equipment, and his own personal views of heat transport processes.

In general, the book appears to contain many controversial and, at times, perplexing statements. Little effort, however, is actually needed to grasp the gist of the book. For example, the drawback of the concept of the heat transfer coefficient (which mathematically assumes a linear relationship between heat flux, q, and temperature difference, ΔT) when applied to highly nonlinear convective heat transfer processes, can be readily understood. On the other hand, the reader is likely to find it difficult to concur with some of the author's reasoning, opinions, and propositions. His arguments for the ultimate rejection of Fourier's law, the Stefan-Boltzmann law, the concept of resistance, and dimensional analysis appear extremely debatable. For the reader accustomed to the concept of heat transfer coefficients, some of the illustrated problems also appear unrealistic.

One obvious weakness of the book is that it neither presents theoretical substantiation for Eq. (1) nor discusses in detail the functions f_1 and f_2 contained therein for different convective heat transfer processes. Presentation of the new approach is thus largely superficial. Crucial questions such as what should be the basis for choosing the parameters when carrying out complex heat transfer experiments, how can a large number of empirical correlations obtained in the form of Eq. (1) be put in a compact and convenient form without utilizing dimensionless groups, and what should take the place of the heat transfer coefficient in a systematic treatment of heat transfer theory, are virtually overlooked. Generally speaking, little proof of the feasibility and practicality of the proposed methods is given. Furthermore, equations or numerical results obtained by the traditional means are sometimes used to illustrate the proposed approach, thus causing confusion and doubt.

In conclusion, it can be said that some of the points brought up in this book may have merit. However, any possible value of the book tends to be lost by highly controversial statements and questionable reasoning.

C. J. Hsu

Brookhaven National Laboratory
Upton, New York 11973

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About the Reviewer: C. J. Hsu is presently a chemical engineer in the Department of Applied Science at Brookhaven National Laboratory. Dr. Hsu has been at Brookhaven since 1962 and has conducted theoretical researches in the field of fluid dynamics and liquid-metal heat transfer. He also served as adjunct professor of mechanical engineering at the Cooper Union for the Advancement of Science and Art in New York City. His current work at Brookhaven involves thermal and hydraulic safety analysis for boiling water reactors and pressurized water reactors using computer codes. He holds graduate degrees from Columbia University and the University of Houston and is the author or coauthor of about thirty technical papers.

Activation Analysis with Neutron Generators. By S. S. Nargolwalla and E. P. Przybylowicz. Wiley-Interscience Publishers, Inc., New York (1973). 662 pp. $29.50.

This treatise is Volume 39 in the Wiley-Interscience series of monographs on Chemical Analysis edited by P. J. Elving and I. M. Kolthoff. At the outset of this review of the book, before getting into any detailed comments, this reviewer would like to remark that the book represents a capable and thorough treatment of a fairly specialized subject—neutron activation analysis (NAA) carried out with small deuteron accelerators that generate fast neutrons.

The book consists of seven chapters, ranging in length from 23 to 351 pages (except for the short 8-page introductory chapter), plus four appendices that total 33 pages, and an index. The main six chapters cover the subjects, respectively, in succession of (Chap. 2) Production and Interaction of Fast Neutrons, (Chap. 3) The Neutron Generator, (Chap. 4) Radiation Hazards and Shielding Considerations for Neutron Generator Facilities, (Chap. 5) Preparation and Transportation of Samples, (Chap. 6) Sources and Reduction of Systematic Error, and (Chap. 7)

Applications. This last chapter, on Applications, is a very long one—351 pages, or more than half of the book.

In general, the authors have done a good job of bringing together in one volume all of the factors that are relevant to the subject of NAA utilizing small accelerators as neutron sources. In fact, this is the only book on this specific subject, so far as this reviewer is aware. It is not designed as a textbook, but rather as a reference book—useful both to newcomers to the field and to persons already quite experienced in this field. In this reviewer's opinion, the book is unnecessarily long, adding to the cost of the book without a proportional addition to its useful content. The treatment of health physics is unnecessarily detailed, and the element activation and decay curves (234 curves) in the chapter on Applications add a great deal to the length of the book without adding much information of real value, inasmuch as all of the resulting information can readily be obtained from a single activation straight-line plot of log (1-S) versus $t_i/t_{0.5}$ and a single decay straight-line plot of log A/A_0 versus $t_d/t_{0.5}$, plus the 78 element activation/counting tables included in the chapter. Many of the 48 graphs in Chap. 2 are of little use, and could well have been eliminated. Three other criticisms of the book are (a) the undue attention devoted to NAA with 3-MeV (d,d) neutrons, (b) the inadequate attention devoted to thermal-neutron activation analysis, using a moderator to thermalize the 14-MeV neutrons, and (c) the inadequate discussion of the great advantage of modern sealed-tube 14-MeV neutron generators, compared with the far more troublesome drift-tube generators.

In general, the book appears to be unusually free of typographical errors [one exception being Eq. (2.12), in which the product should be ^{3}He, not ^{3}H]. In Table 2.6, the half life of ^{197m}Au should be shown as 7.2 sec (the units were omitted). On p. 52 it is stated that $(n,2n)$ reactions are predominantly endoergic, whereas all $(n,2n)$ reactions are endoergic. On p. 57, reference is made to the analysis of nitrogen in hydrocarbons, whereas it should be referred to as the determination of nitrogen in impure hydrocarbons (or as the analysis of impure hydrocarbons for nitrogen). Especially in Chap. 3, the authors use many English units, rather than using metric units or giving both. In Chap. 4, the authors refer to buildup of T_2O in the body, whereas any tritium present in the body as water is entirely in the form of HTO. The authors still use the old terminology of "beta rays," rather than "beta particles." In Chap. 6, on Sources and Reduction of Systematic Error, no mention is made of the most precise and most accurate oxygen determinations yet made by anyone, using 14-MeV neutrons—namely, the fine work done and published by Alexis Volborth. In Chap. 7, the NAA method is compared with the atomic absorption method, but only the flame method is cited. The better sensitivities attainable for many elements by the flameless atomic absorption method (using a graphite furance or a tantalum ribbon) are not mentioned. In Appendix II, specific activities of various reaction products are tabulated for an irradiation time of 10 h, which is extremely unrealistic. Nowhere in the book is the Activation Analysis Service of General Atomic mentioned, although this commercial service (started in 1961) included 14-MeV NAA measurements as well as reactor NAA measurements, and the 14-MeV neutron service for oxygen determinations still operates through Intelcom. During its 14 yr of operation, this service has performed more than 100 000 oxygen determinations for a large number of clients.

Coverage of the literature in the book is extensive. A total of 471 references are cited (including a number of repeats). However, although the manuscript was completed in early 1973, the literature coverage essentially stops with 1970, with only two 1971 references and only two 1972 references. One particular omission from the references—noted with chagrin by this reviewer (!)—is the extensive (29 pp.) review article on "Neutron Activation Analysis with Small Accelerators," presented by this reviewer at the First Oak Ridge Conference on Small Accelerators, and published in the *Proceedings*. Failure to cite this fairly extensive reference is even more strange when it is noted that Eq. (2.26) in the book, and all of the discussion pertaining to this equation, is taken from this review article, and the equation was derived by this reviewer. Whereas Appendix III in the book tabulates experimentally determined 10^9 flux 14-MeV-neutron [and 10^7 n/(cm^2 sec) thermal-neutron] sensitivities for various elements, no mention is made of similar experimental sensitivity tables obtained in this reviewer's former laboratory (General Atomic) and published in two extensive NAA chapters in widely used books: the *Treatise on Analytical Chemistry*, and *Physical Methods of Chemistry*. The authors list one reference as a private communication from this reviewer, and that one is given completely wrong!

To repeat the comment made at the outset of this review, however—despite some shortcomings, a number of which have been cited above—this is a good book on the subject, and a useful addition to the literature.

Vincent P. Guinn

University of California
Department of Chemistry
Irvine, California 92664

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About the Reviewer: Again we welcome Vincent Guinn, professor of chemistry on the Irvine campus of the University of California, to these columns as a reviewer of books on radioisotopes and their uses. Prof. Guinn earned his PhD in physical chemistry at Harvard in 1949 and, before returning to the academic world, had wide experience in industry, most recently with Gulf General Atomic. His principal interests are in radiochemistry, radioactive tracers, and activation analysis.

Functional-Analytic Concepts and Structures of Neutron Transport Theory. Vols. 1 and 2. By Marjan Ribarič. Slovene Academy of Sciences and Arts, Ljubljana, Yugoslavia (1973). 1104 pp.

These volumes represent the organization of a large number of physical assumptions about the transport of neutrons into a large mathematical framework. The work is very ambitious, containing over 1100 pages and representing 11 years of labor. It is very theoretical and should have appeal to readers with strong interests in applied functional analysis and transport theory. However, it may not be of much interest to readers who are concerned mostly with practical applications.

The author's main effort is to develop a mathematical theory based on a large number of physical assumptions about the behavior of neutron "traffics" on the surface of a material body, D. In particular, the author is concerned about the mathematical relationship between the neutron traffic i_+ that leaves D and the entering neutron traffic i_-.