of computer codes, two examples of transient analysis are given: design basis depressurization accident and natural circulation cooling.

Chapter 6 is divided into three parts: R. Duffey (Electric Power Research Institute) on PWR steam generators, G. Robin (Commissariat à l'Energie Atomique, France) on intermediate heat exchangers (IHXs) and steam generators for LMFBRs, and P. Hunt and M. Lasarev (formerly of GA) on helium-heated steam generators. While steam generator design had often seemed less glamorous than core design, the importance of steam generators to plant economics and safety has become increasingly obvious for all reactor systems. After discussion of thermal design principles and of various commercial designs of PWR steam generators, a simplified formula is derived for the recirculation ratio. Thermal hydraulics of bundle support plates is discussed, and a sample computation of steam generator performance is provided. A good review is given of safety analysis of PWR steam generators, natural circulation, steam generator dryout, loading due to decompression after primary or secondary side failure, effect of secondary to primary flow leakage on reflood rate, and condensation induced pressure pulses. Like all chapters, there is a list of references and also a couple of problems.

The IHX in an LMFBR is a heat exchanger between the primary (reactor) sodium and the secondary (nonradioactive) sodium transporting the heat to the steam generator; the IHX usually operates above 500°C in both loop- and pool-type reactors. But most of the chapter's emphasis is on steam generators, which are always critical components of most LMFBRs because of the need to prevent both sodium/water and sodium/air reactions. Following a good discussion of the main design features of British, French, Russian, and U.S. steam generators, pressure drop and heat transfer correlations are given for the water side, since the sodium correlation utilized for the IHX design (given in the first part of this chapter) are still applicable. Comparison with test data is shown for the French reactor Phénix, and special correlations for Nusselt number and friction factor for water, steam, or two-phase mixtures are indicated for helically coiled tubes. Several interesting problems follow a broad international list of references.

A discussion of HTGR steam generators is included in the last chapter with emphasis on once-through helically coiled systems such as those for the (operating) Fort St. Vrain 330-MW(electric) reactor. Empirical correlations are given for gas-side (i.e., shell-side) heat transfer and pressure drop. Recommended Nusselt number and friction factor correlations are also given for the water side of the coiled bundles as compared to a straight bundle, for a number of conditions, but without comparison with test data and without indication of uncertainties. The chapter ends with short discussions of static and dynamic stability and of design limitations.

The book ends up with two useful appendixes, one on conversion factors and the other one on thermal properties of sodium. It is the only comprehensive textbook on the thermal hydraulics of all nuclear reactor systems, and thus it will serve as a useful single source of information in spite of some of its drawbacks, mostly due to the mosaic of authors. The editor is to be congratulated for having succeeded in convincing so many international experts to contribute. This book should be very useful for nuclear engineers involved in thermal or fast reactor design and also for teaching advanced nuclear engineering courses in graduate schools. The minor misprints and inconsistencies noticed could easily be corrected in the next edition.

G. B. Melese-d'Hospital obtained his PhD in fluid mechanics at Johns Hopkins University and subsequently worked on the first French gas-cooled reactors at Saclay from 1954 to 1957. After teaching nuclear engineering at Columbia University, he joined General Atomic Company in 1960 and has been involved in designs of gas-cooled thermal, fast, and fusion reactors since that time. Together with R. Katz, he is finishing the manuscript of an ANS monograph on thermal hydraulics of helium-cooled reactor systems. Dr. Melese-d'Hospital is a fellow and a past director of the ANS and is currently visiting professor of nuclear engineering at MIT.

Adsorption from Aqueous Solutions

Author	P. H. Tewari
Publisher	Plenum Publishing Corporation, New York (1981)
Pages	248
Price	$35.00
Reviewer	Arthur L. Reesman

This volume is the final product from a symposium of the same name that was held in March 1980 at the American Chemical Society meeting in Houston. It contains 12 research papers on various aspects of current research in adsorption from aqueous media.

Five of the papers are devoted to research in which oxide surfaces are the dispersed phase. Two of these deal with TiO_2-H_2O systems: One treats the system as a model colloidal dispersion; whereas, the other examines the adsorption of alkaline earth ions onto the TiO_2 surfaces. Another study involves the adsorption of transition metal ions onto amorphous FeO(OH) in the presence of several strong bonding anions (e.g., PO_4^{3-}, AsO_4^{3-}, and SeO_3^{2-}). Adsorption of oleate onto hematite surfaces as a function of concentration, temperature, and pH provided information related to the processes of flocculation, dispersion, and the formation of hydrophobic mineral surfaces. The final oxide research explores the interaction of uncomplexed Co^{2+} and complexed Co(III)EDTA$^-$ onto silica and alumina surfaces with the conclusion that hydrogen and -bonds are significant in adsorption in both cases.

The surface chemistry of chrysotile (asbestos) was studied to determine the optimum conditions for wet beneficiation processes that would reduce the airborne fibers relative to present dry processing. Another silicate, kaolinite, was used in a study of the adsorption of polyacrylamide and sulfonated polyacrylamide.

Chitosan, deacetylated chitin, was found to be an effective adsorber of acidic pesticides, such as 2,4,D and 2,4,5-T. The abundance of chitin makes this an attractive method for decreasing these types of pesticides in aqueous solutions.

The dental readership of *Nuclear Technology* will be interested in the study of zinc adsorption onto hydroxyapatite because of the mordant properties of this ion in coupling restoration materials with the tooth. This paper has an excellent treatment on the kinetics of zinc uptake onto the apatite surfaces.

X-ray photoelectron spectroscopy was used to study lead adsorption on MnO_2 and cobalt on illite. Lead appears to oxidize to Pb^{4+} with the possible reduction of manganese at the MnO_2 surface; whereas, Co^{2+} retains its oxidation state on illite, being present as hydrated Co^{2+} below a pH of 6, as $Co(OH)_2$ above 7.5, and probably as $Co(OH)^+$ between pH values of 6 to 7.5. Studies using this technique have provided insights into the nature of surfaces and adsorbed ions, and future studies should help advance the knowledge of surface reactions.

Two papers stand out in terms of probable interest to the readers of *Nuclear Technology*, especially those interested in the migration of radionuclides through soils, sediments, and rocks. The first paper, "The Power Exchange Function: A General Model for Metal Adsorption onto Geological Materials," by Donald Langmuir, describes a model using two empirically determined constants and mass-action type equations for studies of cation adsorption. The model appears to work well for a large number of cations onto a variety of mineral surfaces. The second paper by Beall and Allard is "Sorption of Actinides from Aqueous Solutions Under Environmental Conditions." Their study showed that the oxidation reduction potential and pH of natural aqueous systems were considerably more important in the sorption of actinides on minerals than simple ion exchange.

In essence, there are 12 in-depth studies over a broad subject in which the common thread is the aqueous media. Although the papers are excellent, the volume is probably more suited for library purchases rather than personal use because of its diversity. However, almost anyone interested in surface chemistry should find one or more papers to be significant.

Arthur L. Reesman (BS, chemistry, Eureka College; MS and PhD, geology, University of Missouri) is an associate professor of geology at Vanderbilt University. His research interests are in low-temperature geochemistry. Past studies have included the behavior of both major and trace elements during chemical weathering and the genesis of clay minerals. He is currently pursuing studies in stratiform mineral deposits.

International Advances in Nondestructive Testing (Vol. 8)

Editor Warren J. McGonnagle

Publisher Gordon and Breach, Science Publishers, Inc. New York (1981)

Pages 352

Price $69.50

Reviewer Otto Buck

This is the eighth volume of a series that "publishes original research, development and application papers relating material properties to measurable physical phenomena," as stated in the Preface to the above-titled book. It contains 13 papers that indeed deal with a wide range of topics, including theoretical and laboratory investigations as well as applications to industrial problems.

This eighth volume places heavy emphasis on research-oriented papers. One of these papers deals with a new method for shaping and time-domain analysis of pulsed acoustic signals; according to the author, this may be a method that could replace the more complicated spectral analysis and could be used to distinguish various types of signal-attenuating mechanisms. Important to transducer design is a report on a computer study discussing the effects of the acoustic transducer/material interface, which can produce distortions of the ultrasonic signal. Multiple eddy-current measurements are the subject of another paper. The authors report on the application of a computer to sort out various materials properties with decision logic. The operation and design of photodiode arrays, useful to x-ray imaging and analysis, are briefly discussed in another article. A general paper on methods and means for error control in precision instruments is also included.

The more materials-research-oriented papers also deal with a variety of subjects. One of these papers, a review, discusses the present status of ultrasonics to determine fracture toughness nondestructively. Another review gives a short overview on the use of x rays to determine residual stresses. A progress report on the use of acoustic emission during fatigue crack propagation studies in hydrogen embrittled Zr-Nb alloys is also included. Finally, the use of electrical discharge to characterize the topography of a surface (due to fatigue, for example) is briefly discussed.

One of the applications-oriented papers describes experiences gained in growing and acoustic monitoring of cracks of known size, location, and orientation (Heavy-Section Steel Technology Program). Another report deals with a semi-automatic ultrasonic thickness gauge for evaluation of boiler generator tube corrosion. The accuracy and repeatability of eddy-current measurements on tubes in the field—according to ASME recommendations—is discussed in a third paper. All the applications papers give a good insight into some of the real-world problems.

In general, this volume contains one or more articles for anyone interested in nondestructive testing. Aside from some typographical errors, most of the papers are of good quality with one exception. A paper on optical sonar system concepts should have been edited and retyped before printing. Even worse, the figures have not been included. Overall, however, this volume seems to be a worthwhile addition to the nondestructive testing literature.

Otto Buck is a senior scientist and Section Chief at Ames Laboratory, Ames, Iowa. His major research interests included mechanical properties and nondestructive evaluation. He also teaches mechanical metallurgy at Iowa State University.