BOOKS

Plant Design and Economics for Chemical Engineers, Max S. Peters, McGraw-Hill Book Company, Inc., New York (1958). 511 pages. $11.00.

Consideration of the complete chemical plant rather than the individual unit operations and processes marks one of the objectives of chemical engineering education. This book, which is directed toward the attainment of that objective, effectively combines the engineering principles of plant design with the essentials of economic analysis.

Emphasizing the interdependence of the cost and engineering aspects of the design the author introduces the economic viewpoint by detailing the costs involved in the construction and operation of the chemical plant. Later chapters discuss investment costs, interest, depreciation, replacement costs, and the evaluation of alternative investments. Taxes and insurance are discussed in a brief chapter which will be of considerable value to the novice. Cost-estimation methods used in evaluating chemical plant construction and operation are presented in detail. A chapter on cost and asset accounting surveys the methods and terminology used in this field. These sections are especially pertinent because the effects of present tax and depreciation policies are included.

Half the book is devoted to equipment—design methods and cost data. The development of more detailed methods is preceded by a chapter devoted to a general discussion of scale up, methods of fabrication, safety, corrosion problems, and materials of construction. Optimum design concepts are developed and applied in examples. Design methods and recent cost data are presented for piping, pumps, heat transfer equipment, mass transfer equipment, and filters. Prefacing certain of the design sections are rather complete outlines of applicable, fundamental unit-operations theory. Cost information is also given for other types of equipment.

The presentation of topics which represent combinations of the economic and technical points of view is, in the opinion of this reviewer, of primary importance, since these are not readily available in the proper form. Under the heading of general design considerations the author presents brief discussions of plant layout, location, and safety, structural design, instrumentation, and patent law. Perhaps the treatment of these topics could have been expanded at the expense of the more fundamental portions of the equipment-design sections. Additionally waste treatment and disposal and design report writing occupy a chapter each. Sections of the material on report writing might have been ommitted in favor of other topics.

Illustrative examples are included and are used, where applicable, to clarify the various topics. Unsolved problems are given at the end of most chapters, and longer design problems are included in the appendix. Adequate bibliographies are included for most topics, and the listing of cost references is recent and usefully organized.

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require an uninterrupted, reliable, and constant source of heat for their continuously operating processes. In many plants, load factors of 90 to 95% of demand are the rule rather than the exception. Those conditions are ideal for nuclear reactors.

On the basis of recent experience, it is safe to assume that the potential market is 50 to 100 process steam-generator units a year. **Nuclear Considerations in Design of High-Temperature-Process Heat Reactors,** J. T. ROBERTS. Designers of high-temperature-process heat reactors must be careful not to rely uncritically on nuclear generalizations based on low-temperature thermal reactors. Differences are reflected in differences in critical size and mass and in control problems associated with temperature coefficient of reactivity and degree of fuel burn-up attainable before processing. **Design of a Plant for Recovery of Uranium by Liquid Ion Exchange (Solvent Extraction),** KATHLEEN BLACK AND JOSEPH KOSLOV. A process description for the recovery of uranium from sulfuric acid leach solutions by solvent extraction, designed to process 600 tons of ore daily, is presented. **Indirect Cycle Nuclear Reactor System to Furnish Process Heat,** R. CARSON DALZELL AND JAMES P. MCGEE. Use of nuclear fission for chemical process heat offers the special advantage of high temperature, limited only by materials of construction. The process heat may be supplied economically at elevated pressures, since no compression of combustion air is required. The major problems are the design of high-temperature fuel elements, construction of an exchanger to transfer heat to process streams in the range of 2,500°F., and development of compressors capable of recycling helium at 1,000°F. and above. **Direct Utilization of Fission Energy for Radiation Processing,** WARD S. DIETHORN, PAUL SCHALL, JR., AND G. D. CALKINS. Radiation-induced degradation, polymerization, and synthesis of both organic and inorganic compounds have been reported. High chemical yields in some of these systems suggest the possibility of utilizing radiation sources for the commercial production of chemicals.

If fission recoils could be utilized in a reactor, it would be a highly efficient radiation processing source. The purpose of this paper is to discuss a reactor application of this type. **Experimental Determination of Dose Distribution in the Proposed Fir Gamma Irradiator,** B. MANOWITZ, D. M. RICHMAN, L. GALANTER, AND O. A. KUHL. This paper presents an experimental program to determine the depth-dose distribution in food packages for several gamma irradiator geometries and to examine the nature of aqueous, indium-salt solutions. The experimental results of the irradiator experiments were compared to theoretical calculations of depth-dose distributions and reactor power required for one particular irradiator geometry. **Engineering Continuous Filtration to the Uranium Ore-Processing Flow Sheet,** C. F. CORNELL, R. C. EMMETT, AND D. A. DAHLSTROM. Rapid development of uranium-ore milling has required the solution of several difficult and critical liquid-solids separations. Filtration has been given a large place in the flow sheet in finding these solutions. Filtration theory, test procedures, methods of correlation, and filter construction had to be developed. **High-Operating-Temperature Reactor Design,** JOSEPH DEFELICE. The design presented affords a method of immediate entry into the field of high-temperature nuclear reactors for chemical processing. The reactor described is, in essence, a test reactor for the development of high-temperature fuel elements. **Process Applications and Construction Materials for a High-Temperature Nuclear Reactor for Chemical Processing,** LEON DAVIDSON AND ALFRED A. STRASSER. A preliminary study to explore the design and application of a high-temperature process heat reactor.

With known technology a relatively small demonstration reactor could be built in which an insulated central fuel region, running at high temperature, could be used to develop and demonstrate high-temperature components. **The Effects of Gamma Radiation on Several Polysulfone Reactions,** BRUCE G. BRAY, JOSEPH J. MARTIN, AND LEIGH C. ANDERSON. The advent of the atomic energy program stimulated many research activities to discover uses for the high-energy radiation made available in the fission products of the nuclear reactors. The use of this radiation as a catalyst in chemical reactions has been shown to be very effective in certain cases and may prove to be advantageous on an industrial scale.

ADSORPTION, DIALYSIS, AND ION EXCHANGE, Vol. 55, No. 24, 1959

Similarities in Adsorption, Dialysis, and Ion Exchange, G. P. MONET. If adsorption, dialysis, and ion exchange are grouped together, there are many obvious similarities of a physicochemical and chemical engineering nature. Classification of the three fields into one is expected to facilitate chemical engineering instruction, to stimulate further research, and lead to increased commercial application. **Adsorption Equilibria,** DONALD GRAHAM. The nature and energies of adsorption are reviewed with particular reference to its use in clarification or fractionation. Experimental techniques for obtaining adsorption equilibrium data and analytical methods for their interpretation are reviewed. Factors which should be considered in the selection of an adsorbent for a specific purpose are discussed, and methods for handling solid adsorbents in fluid media are outlined. **Kinetics of Batch Adsorption of Dichlorophenol on Activated Carbon,** S. B. SMITH, A. X. HILTGEN, AND A. J. JUHOLA. The rate of adsorption of 2, 4-dichlorophenol from aqueous solution by granular activated carbons of various sizes and types was followed for 3-hr. periods. The effects of adsorbent structure, particle size, initial adsorbate concentration, temperature, and adsorbent-solution ratio were studied and mathematical treatments tested. A proposed semiempirical treatment permits determination of relative diffusivities within the particles. **Deactivation and Reactivation Phenomena During Charcoal Adsorption of Hydrocarbon Gases,** R. F. BADDOUR AND R. L. GEDDES. The effect of hydrocarbon pyrolysis gas on the adsorptive capacity of activated petroleum coke was explored in bench-scale experiments with fixed char beds. Deactivation and reactivation phenomena were studied at varying conditions in an effort to gain information useful in commercial design work. **Molecular Sieves,** G. J. GRIESMER, R. A. JONES, AND HARRY LAUTENSACK. Since molecular-sieve adsorbents were introduced, they have been applied by the process industries to the drying and purification of a large variety of gas and liquid streams. This paper deals with the properties and uses of molecular sieves. **Application of Ion Exchange Equilibrium Relationships to Process Design,** NORMAN W. FRISCH AND FRANCIS X. MCGARVEY. Kinetic relationships which describe ion exchange processes have been developed, each relationship depending upon a mass balance, a rate equation, an equilibrium relationship (isotherm), and a set of boundary conditions. In many design applications, expressions based on equilibrium concepts yield important process information. **Kinetic Relationships for Ion Exchange Processes,** THEODORE VERMEULEN AND NEVIN K. HIESTER. Efforts to place ion exchange and related adsorption operations on a sound theoretical basis are reviewed. Graphs and tables are cited which present the results of complex mathematical analysis in readily usable form. Finally, resin utilization and regenerant efficiency important in the economic design of processes for cyclic operation are discussed. **Ion Exchange Kinetics,** R. L. MOISON AND H. A. O'HERN, JR. New data were obtained on ion exchange in deep, fixed-bed equipment. The data for favorable equilibria were correlated by a variation of the "exchange zone" concept of Michaels, and the results revealed that liquid-phase diffusion is controlling with feed concentrations of 0.01 to 0.10 *N*. Heights of transfer units were found to be proportional to the 0.4 power of Reynolds number and the 0.3 power of the ratio of bed depth to particle diameter. **Semicontinuous Countercurrent Apparatus for Contacting Granular Solids and Solution,** C. W. HANCHER AND S. H. JURY. Progress is reported in the field of semicontinuous countercurrent ion exchange at Oak Ridge National Laboratory. Additional operating data are given on a 12-in. diameter pilot-scale slurry contactor operating on low-grade Western uranium ore. Hydraulic data from a 36-in. contactor with new types of pulsing mechanisms are presented to show the decreased effect of wall resistance in the larger contactors.

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Professor Peters has written a readable book which emphasizes the dual economic and technical basis for plant design. It will be of use to chemical engineering students and practicing engineers not directly concerned with cost estimation.

J. FRIEDLANDER