

Nucleation and Growth of Thin Films. By B. LEWIS AND J. C. ANDERSON. Academic Press, New York, London, San Francisco, 1979. 504 pp., \$57.00.

In 1939, Max Volmer published his "Kinetik der Phasenbildung," twenty-four years later "Condensation and Evaporation—Nucleation and Growth Kinetics" by J. P. Hirth and G. M. Pound, and another five years later "Kinetics and Mechanism of Crystallization" by R. F. Strickland-Constable appeared (to name a few classics). In these publications crystal growth on solid surfaces was considered within the framework of crystal growth phenomena in general. With the increasing interest in thin solid films, a larger demand for information on nucleation and growth on surfaces became obvious and it was met by collections of review articles, e.g., the series on epitaxy and endotaxy (1969, 1971, and 1976) by H. G. Schneider and by H. G. Schneider and V. Ruth, and the two-volume series on epitaxial growth by J. W. Matthews (1975).

Lewis and Anderson, the authors of the present book, "felt that the time was right for consolidation in a definite book." Since the list of contents establishes the scope and outline of the book, the main topics shall be quoted here:

- (1) Arrival and Adsorption
- (2) Adsorption Forces
- (3) Adatom Migration and Cluster Growth and Decay
- (4) Steady-State Nucleation Theory
- (5) Steady-State Nucleation Rates
- (6) Time-Dependent Nucleation: Non-Computational Treatments
- (7) Time-Dependent Nucleation: Simulation Synthesis and Advanced Analysis
- (8) Nucleation and Growth on Preferred Sites
- (9) Nucleation and Growth Experiments
- (10) Coalescence and Growth
- (11) Epitaxial Deposition

"Within this scope [the authors] attempt a unified coherent account of developments and also examine some points of detail normally overlooked. Particular attention is paid to comparisons between apparently diverse treatments, such as the classical and atomistic nucleation models, and the uniform depletion, lattice and ring models of surface diffusion capture." While Hirth and Pound, for example, only *point out areas* where theory and experiments are not in agreement, the present authors *omit* work believed to be incorrect. Here lies a danger the reader should be aware of. It is quite obvious that it is impossible to cover in about 500 pages all the material for which other authors had the space of several volumes available. Nevertheless, it would have been more satisfactory if a little more recent material could have been considered. In the chapter on adatom migration, for example, none of the work by G. Ehrlich or T. T. Tsong is mentioned. If their work would have been considered,

Figure 2.7b would look slightly different. It also would have been preferable if the authors would talk consistently about "specific surface free energy" instead of "surface energy" when they discuss the surface tension. R. Havemann, for example, who is today better known for his political struggles in East Germany, fought this battle 22 years ago in his book on chemical thermodynamics.

It was the authors' goal to develop the material logically and self-consistently, setting each treatment in its context with the other. Here lies the value of the book; here it beats the above-mentioned review collections, which were written by groups of authors, but it does not make them superfluous. The book is valuable to those who look for a "comprehensive survey of the theories of nucleation and the initial stages of growth of thin films."

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Colloid Science, A Specialist Periodical Report, Volume 3. A Review of the Literature Published 1974-1977. Senior Reporter, D. H. EVERETT. The Chemical Society, London, 1979. 337 pp. \$48.50.

Colloid Science is a vast interdisciplinary field. Thus, it is impossible to expect that a 3-year progress of the entire discipline be reviewed in a small volume. Indeed, this book deals only with the adsorption phenomena at solid/gas and solid/liquid interfaces, insoluble monolayers, emulsions, and micelles. The topics are not related and even within a given area the coverage of the problems is selective.

In Chapter 1 on the "Adsorption at the Gas/Solid Interface" D. Nicholson and K. S. W. Sing discuss some classical problems of physisorption with emphasis on the concepts and problems of microporosity. They review the Brunauer and the Dubinin ideas on the subject and then offer a survey of statistical mechanical treatments for adsorption in micropores. In addition, phenomena related to surface effects in flow and diffusion of gases, with special reference to zeolites, are examined; 255 references are cited.

Chapter 7 by T. Cosgrove deals with "Spectroscopic Measurements at the Gas/Solid Interface." The applicability of different techniques (infrared, multiple internal reflection, ir, nuclear magnetic resonance, electron spin resonance, electron spectroscopy, neutron scattering, laser Raman spectroscopy, Mössbauer spectra, etc.) to characterization of adsorbed species in terms of their structure and configuration is discussed. Results obtained with particular adsorbents (zeolites, silica, glass, metal oxides, carbon) are reviewed and 216 references are given.

D. H. Everett and P. T. Podoll (Chapter 2) extensively surveyed the "Adsorption at the Solid/Liquid Interface: Non-electrolyte Systems," exclusive of polymer adsorption. After the thermodynamic analysis of the problems is reviewed, the authors discuss the progress of the surface area determination and the relationship between the gas adsorption and adsorption from solution. Furthermore, adsorption from dilute and multicomponent solutions, respectively, is treated in some detail. Finally, a number of specific systems, involving a variety of adsorbents and adsorbates, is reviewed (190 references).

Chapter 3 by G. T. Barnes is devoted to "Insoluble Monolayers—Dynamic Aspects," which complements an earlier report on equilibrium aspects of surface films. Surface shear viscosity is discussed first and the theoretical and experimental progress, made in this field by F. C. Goodrich, is reviewed in particular. Different techniques for the study of time dependent processes in monolayers with time scales ranging from milliseconds to kiloseconds are summarized. Other topics in this chapter deal with mass transport through, penetration of, and reactions in monolayers with a special consideration of biological systems (320 references).

Emulsions (Chapter 4) are discussed by B. Vincent and S. S. Davis. Since a considerable number of review articles on the subject appeared in recent years, these publications are listed first. The rest of the chapter deals with the usual topics relevant to the subject, i.e., nonspontaneous and spontaneous emulsification and emulsion stability and properties (140 references).

In a short survey (Chapter 5) J. F. Goodman and T. Walker consider factors responsible for "Micellization in Aqueous Solutions." They conclude that a proper understanding of various parameters as they affect micelle size and shape has not been developed as yet. The major obstacle to accomplishing this goal is our lack of knowledge of the problems related to water structure and hydration (37 references).

Finally, the important problems of "Structure and Reactivity in Micellar Aggregates" are reviewed by J. M. Brown in Chapter 6. Special attention is given to micellar catalysis and a large number of reactions accelerated by different types of micelles are discussed in some detail (191 references).

The readers interested in the listed topics will find the extensive literature citations most useful, although the price for the small volume (\$48.50) is nothing less than exorbitant.

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Zeolites and Clay Minerals. By R. M. BARRER. Academic Press, New York. 52.50 (£25.00).

This monograph, written by Professor R. M. Barrer who has been a leader in zeolite research for many years, concentrates on the structural, physicochemical, and theoretical bases of sorption and intercalation by zeolites and clay minerals. The monograph begins with the chapter on the nature of zeolites and some of their uses, with special attention given to sorption, catalytic, and ion exchange properties and applications. The following chapter gives an excellent review of the zeolite frameworks and complete structure of the zeolites if known to include the cation and water molecule positions. The following three chapters deal with the equilibrium between the host zeolite crystals and guest molecules, the energetics of sorption, and the change of entropy for sorbed molecules. Additional discussion is focused on the thermal entropy and heat capacities of intracrystalline fluids. Chapter 6 discusses diffusion in zeolites starting with the methods of studying mobility of sorbed molecules followed by the interpretation of sorption kinetics. Additional discussion centers on chemical, concentration, and molecular size effects influencing intracrystalline diffusion. The last two chapters give a comprehensive discussion on chemisorption, sorption complexes, and molecular sieving on zeolites with the last chapter concentrating on clays which brings the extra dimension of swelling behavior of clays as contrasted to the rigid frameworks of zeolites.

The monograph is well written, concise in style, and is in keeping with the Barrer tradition. Each chapter has an extensive reference section with substantial contribution from the author's past research in each area giving the treatment of the subject matter an extra personal dimension for both the student and the expert in the field. The book is a must for anyone seriously interested in zeolites and clays and their application as sorbents, catalysts, and molecular sieves.

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Hydrocarbon Synthesis from Carbon Monoxide and Hydrogen, Edwin L. Kugler and F. W. Steffgen, *Advances in Chemistry Series*, American Chemical Society, Washington, D. C., 1979.

For many years it has been recognized that it is possible to convert catalytically carbon monoxide and hydrogen into methane or into higher hydrocarbons. With the advent of the current energy crisis and the continuous rise in our oil imports attention is again