

BOOK REVIEW — BUCHBESPRECHUNG

T. ERDEY-GRÚZ and G. SCHAY: Theoretical Physical Chemistry

Published by Tankönyvkiadó, Budapest 1952—154, Two volumes (622+864 pages).

Contents: I. Historical survey. II. Atomic structure. 1. Matter, electricity and light. 2. Electron-clouds and theory of spectra. 3. Atomic nucleus.

III. Structure of atomic systems (molecules and continuous matter) 1. Molecular spectra. 2. Determination of structures with X- and electron-rays. 3. Dielectric and magnetic properties. 4. The chemical bond.

IV. The laws of thermodynamics and fundamental principles of statistical mechanics 1. Basic conceptions. 2. The first law of thermodynamics. 3. The second law of thermodynamics. 4. Thermodynamic potential functions and general criteria of equilibrium. 5. The fundamental principles of statistical mechanics.

V. One-component systems. 1. Perfect gases. 2. Real gases. 3. Crystalline solids. 4. Liquids and amorphous solids. 5. Phase-diagrams and their applications.

VI. Multicomponent systems. 1. Properties of homo-

geneous mixtures. 2. Dilute solutions and ideal mixtures. 3. Two-component non-ideal mixtures. 4. Phase-equilibria in multicomponent systems. 5. Transport phenomena in liquid solutions.

VII. Chemical equilibrium 1. Homogeneous equilibria. 2. Heterogeneous equilibria.

VIII. Adsorption 1. Adsorption at the free surface of liquids. 2. Adsorption of gases and vapors on the surface of solids. 3. Adsorption from mixtures and solutions.

IX. Reaction kinetics. 1. General principles. 2. Transition states: simple and stepwise mechanisms. 3. Chain-reactions and catalysis. 4. Surface reactions.

X. Electrochemistry 1. Basic phenomena. 2. Conduction of electricity in electrolytes. 3. Galvanic cells and phase potentials. 4. Equilibria in electrolytic solutions. 5. Electrolysis and polarisation. 6. Electrocapilarity and electrokinetic phenomena.

This textbook for university students is not the usual type that contains no more than the professor's lectures and the subject of examinations. At the very outset it was conceived to satisfy all special claims at each university of the country. In addition to this, some deeper reasons underly its new character. Physical chemistry is a discipline hard to master. It requires preparations in two directions: to recognize the basic connections of the subject, and to acquire some detailed practical knowledge. Only such twofold acquaintance with physical chemistry may result in the specific mentality, that will enable the student to apply his knowledge in other fields as well (e. g. for chemical engineers particularly in technology), which, in fact, is the ultimate aim of this study. Though the authors contrive to alleviate the work of learning in both directions, they incite the students to learn in a new manner, that is *to elaborate* the subject on the basis of the lectures by means of the textbook. Indeed, a good textbook and adequate lectures can do much more for the realization of this pedagogical principle, than any kind of organizational measures. On the other hand, it cannot be denied that beside its unusual and novel character, its volume is also remarkable, though not excessive when compared to its contents and structure, since these enable the students to distinguish the essential, and moreover, with the certainly indispensable aid given by lectures and numerical exercises, the difficulties of its handling may be conveniently overcome.

"Theoretical Physical Chemistry" is also a handbook for practical chemists who can easily find in it at least the fundamental notions for tackling any concrete problem. Details serving purely didactic purposes are, therefore, omitted: the reader is initiated into each individual subject step by step and only after a thorough and successive analysis of the details is he given the synthesis of the pertaining independent phenomena. (This method is not disadvantageous for

students either, because they get used to look through the book after the lectures, to find the relevant paragraphs and will not learn page after page.) Experience shows that our chemists everywhere in the country make good use of this book which thus contributes to the enhancement of the interest for physical chemistry.

Physical chemistry is a par excellence theoretical science; in German and French usage "theoretical chemistry" equals "physical chemistry". Although the theoretical character of this book is stressed even in the title, one can hardly find any other work on physical chemistry that would go so far in accentuating and elaborating of the practical applicability of theory. This fact is closely connected with the lecturing methods of the authors. Problems are propounded, wherever possible, from an experimental point of view, then the theoretical laws of physical chemistry are expounded to explain the experimental facts, and at last there is a return to the application of the theoretical theses in practice. Indeed, nothing would make a more splendid propaganda for physical chemistry than to demonstrate the concrete and instant help it offers to chemists, chemical engineers, and technicians in industry to acquire scientific foresight, since the whole book exemplifies the fact that the deeper the penetration into theory, the more we gain in practice, it is, in itself, a demonstration against any practicicism and amateurism.

The importance of theoretical physical chemistry once recognized from this angle had a considerable influence on the selection and the treatment of the matter. The requirement was to elaborate the up-to-date and possibly complete system of physical chemistry by a rigorous but not self-centred treatment. This mode of treatment is responsible for the great volume of the book.

Two remarks must be made in this connection: we regret to find no independent chapter on colloidal chemistry in the book, though the Hungarian literature is in possession of an exhaustive "Colloidal Chemistry" by A. Buzágh. On the basis of the notions already introduced, it would not have been too difficult to build up a colloidal chapter of appropriate extent and contents. In some places (*e. g.* in the chapter on adsorption) authors involuntarily transgress the "limits" of colloidal chemistry.

The second remark concerns the treatment of the Soviet physico-chemical literature. This has been incorporated in the book according to the system adopted (for example the illustration of the results of the Soviet adsorption school is excellent) and thus Soviet pioneer work in some important fields and, in others, contribution of Soviet science and criticism to results obtained in other countries are thrown in bold relief. There appear, however, some insufficiencies in this respect, for example, in the field of the physico-chemical analysis (Kurnakov's school), or in reaction kinetics (Semenov), where the role of diffusion and heat transfer is treated too perfunctorily (though in the authors' opinion expressed in a foot-note, this field falls beyond the scope of the book).

Recent Hungarian achievements in physical chemistry are duly dealt with, and used partly as examples within the comprehensive treatment of the relevant subject.

Two characteristic features of the rigorous and throughout consequent treatment must be mentioned separately.

No doubt, the exactness of definitions and concepts is extremely important in order to avoid confusion or incorrect inferences. But a simultaneous formulation of the essential and of all its limiting conditions and stipulations does not seem to be a propitious method because it diverts the attention from the essential and renders the process of concept formation more difficult for the reader unacquainted with the subject (see, for example, the definition of reaction rates, Chapter IX. 2. §).

The rigorous treatment also requires the application of the necessary mathematical apparatus. Mathematics may promote or hinder comprehension, according to the mode and purpose of its use. Much depends on whether the problem expressed in abstract mathematical language is made thereby more comprehensible, more concrete, more descriptive than by general explanation and by examples. The avoidance of mathematical formalism is a big merit of the authors.

On the other hand, it cannot be considered a lucky course that in several cases they omit the detailed solution of mathematical problems and give only the results with reference to some known mathematical textbook. In many cases the details of the mathematical solution are useful, instructive and at the same time teach the use of the mathematical apparatus. This is necessary not only to the students but also to other readers who use the "Theoretical Physical Chemistry" as a handbook.

On the whole, thanks to the rigorous treatment and the lucid style, the book is comparatively easy to understand. It surpasses in every respect the authors' previous book, "Physical Chemistry", written together with Gy. Gróh fifteen years ago. This new product of the Hungarian chemical literature will stand the challenge of the best books on physical chemistry in the world literature and many of its parts offer more in several respects than some special textbooks or handbooks devoted to one or another major fields of physical chemistry. "Theoretical Physical Chemistry" is a big success of Hungarian scientific book publishing.

P. BENEDEK

Dr. ZOLTÁN CSÚRÖS: Műanyagok (Plastics)

A text-book for students in chemical engineering

Tankönyvkiadó, Budapest 1956, 792 p.

Contents · Part I. General Characteristics of Plastics. 1. Introduction, 2. definition of plastics, 3. production of plastics, 4. fabrication of synthetic resins, 5. types of bonds suited for polymerization, 6. effect of physical factors on polymerization processes, 7. polymerizing methods, 8. natural base plastics.

Part II. Kinetics and Mechanism of Polyreactions. 1. Polycondensation, 2. polymerization, 3. kinetics of polymerization reactions, 4. effect of the main factors on the polymerization process, 5. copolymerization.

Part III. Physico-Chemical Properties of Plastics. 1. Morphology and properties, 2. colloidal properties, 3. factors affecting the properties of macromolecules, 4. solubility of polymers, 5. molecular weight of polymers.

Part IV. Physical Properties of Plastics. 1. Plasticization of polymers, 2. rheological properties of plastics, 3. the time effect (relaxation processes), 4. deformations of high elasticity 5. relaxation character of deformations of high elasticity, 6. thermal characteristics of macromolecules: points of solidifying, of conversion of second order and of brittleness, 7. intermolecular forces and the phase structure of polymers, 8. strength and structure of polymers, 9. calculated and measured strength of plastics, 10. permeability of plastics to gases and liquids, 11. electric properties, 12. optical properties.

Part V. Reactions Leading to the Formation of Plastics. I. Plastics produced from synthetic substances. A) Polycondensation plastics, 1. Phenoplasts, 2. aminoplasts, 3. polyesters and polyamides, 4. aldehyde and ketone resins, 5. thio-plasts (polysulphide plastics), 6. silicones. B) Polymerization plastics, 7. ethylene and its derivatives, 8. polyethylene, 9. olefinic polymers, 10. polyvinyl chloride, 11. polyvinylidene chloride, 12. polymers containing fluorine, 13. polystyrene, 14. polyvinyl acetate, 15. polyvinyl alcohol, 16. polyvinyl acetals, 17. polyvinyl ethers, 18. polyvinyl ketones, 19. polyvinyl amines, 20. polyvinyl carbazole, 21. polyvinyl pyrrolidone, 22. allyl compounds, 23. polyacrylates and meta-

crylates, 24. coumarone and indene resins, 25. diene derivatives, 26. synthetic rubber, 27. derivatives of acetylene, 28. polymers of cyclic basic materials, 29. polyurethanes and polyureas, 30. Vulcollane.

II. Plastics produced from natural basis materials, 31. rubber-base plastics, 32. latex and rubber, 33. plastics produced from fatty oils, 34. factice, 35. linoxylene, linoleum, 36. cellulose-base plastics, 37. cellulose ethers, 38. lignin-base plastics, 39. protein-base plastics, 40. plastics made from other natural basic materials.

Part VI. Technology of the Manufacture and Processing of Plastics. 1. technical properties of plastics, 2. mechanical properties, 3. thermic properties, 4. optical properties of plastics, 5. chemical properties of plastics of technical importance, 6. factors responsible for the properties of plastics.

A) Technology of the manufacture of plastics, 7. manufacture of phenoplasts, 8. manufacture of aminoplasts, 9. technology of the production of polyesters and polyamides, 10. technology of the manufacture of aldehyde and ketone resins, 11. technology of the manufacture of thio-plasts, 12. technology of the manufacture of silicone resins, 13. technology of the manufacture of polymerization plastics.

B) Processing and use of plastics, 14. manufacture of plastic threads and films, 15. laminated plastics, 16. hard laminated plastics of non-shrinkable nature, 17. moist molding pulp method, 18. sheets from wood shavings, 19. hard laminated plastics which become soft in the region of the temperature of application, 20. soft, flexible, non-shrinking plastics, 21. fabrication of three-dimensioned fittings, 22. compression molding of thermosetting plastics to fittings of given shape and dimension, 23. use of plastics.

Part VII. Chemical and Physical Investigation of Plastics. I. Chemical tests of plastics, 1. condensation plastics, 2. polymerization plastics, 3. natural-base plastics, II. Physical tests of plastics.

Literature.

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A long existing need in the Hungarian chemical literature for a similar work was satisfied by the recent publication of Z. Csűrös' "Plastics". In response to the demands of both students and professional engineers wishing to extend their knowledge this book expounds the present

state of our knowledge in a coherent and systematic manner. As pointed out by the author himself in the preface, the number of text-books on the subject is found even in the foreign literature to be conspicuously small as compared to the number of handbooks dealing with plastics. Yet the diversity and complex nature of the vast field of knowledge covered by the term "plastics" obviously call for a comprehensive treatment in a uniform system in order to save future students the inconvenience of collecting and compiling eclectically their knowledge on plastics from the various fields of chemistry, physics and mathematics. Without the guidance thus given students embarking upon the subject may fail to recognize certain important aspects, to acquire indispensable information and may overlook significant interrelations.

One of the main merits of the author is his attempt to give a complete survey of the subject matter with its manifold implication in the form of a textbook, without greatly exceeding the volume of a manual. He endeavours to impart to the reader a certain familiarity with the nature, technology and methods of investigation of plastics enabling him thereby to read with understanding and to utilize successfully the original literature on the subject.

The method of treatment adopted is best illustrated by the seven main topics dealt with in the book. The author carefully differentiates between fundamental principles and special applications, between theoretical and technological problems and between topics of research and of everyday practice without, however, impairing the uniformity and interdependence of the material, and the clearness of treatment.

Part I, covering 98 pages is devoted to a general characterization of plastics prepared from synthetic and natural basic materials. Principles and generally accepted laws governing polycondensation are presented together with the basic structural features, basic conversions and common technologies of polymers. The latter includes a description of different methods and processes. In conclusion, plastics prepared from natural raw materials are dealt with. Laying the groundwork for subsequent chapters Part I is a comprehensive treatise written with an excellent didactical sense, giving an exhaustive explanation of all basic conceptions and compiled in an up-to-date fashion.

Part II, by I. Géczy, has been devoted to kinetics and mechanism of polycondensation and polymerization reactions. It gives a comprehensive review of the subject the details of which have hitherto been covered by different scattered publications only. By the proper choice of material, the relatively brief yet clear method of treatment complemented by a slightly more expounded discussion of copolymerization and an up-to-date survey of these reactions is given without, however, getting lost in minute details. (Fig. 20 of this Part is incomplete, owing probably to misinterpretation.)

Part III (43 p.) and also Part IV (73 p.) have been devoted to the theory of structure of plastics. Methods of great importance also in everyday plant practice for the determination of the molecular weight of plastics are discussed in detail. In Part IV, in connection with the problem of plasticization of polymers, the rheology of plastics is given, an analytical and slightly generalized treatment followed by a brief description of electrical and optical properties. Up to the present a very few books on plastics have been successful in introducing this important subject in a similarly concise, clear form, comprising no more than what is essential to the explanation of fundamentals, and omitting details which might lead to confusing the reader.

Part V comprising 310 pages is the most extensive. Production and properties of various plastics, a subject to be found in all conventional books in this field, are described. Attention should be called, however, to the abundant literary data and references as well as to the expert skill displayed in the modern treatment of the interesting material and conveying much information and many ideas to the reader. The discussion of plastics produced from synthetic materials is again followed by a section devoted to natural base products. The chapter "Latex and Rubber" written by Z. Bruckner emphasizing aspects of practical interest deserves special attention. The vast experience and great care of the author, resp. authors, is reflected in every paragraph of

this section. The detailed description or, where this was not feasible, the mere inclusion of methods published recently in the literature greatly contribute to the success of the book.

Part VI written by Prof. R. Balló covers in 126 pages essential technological aspects. Theoretical discussions and topics of mainly laboratory interest of the preceding Parts are thus to the great delight of the practical engineer supplemented by practical instructions of the expert. In describing principles of individual methods, repetitions have been unavoidable. The necessity of tedious back references has thereby been eliminated and the short repetitions occupying a brief space among the copious practical data, information and advice enhance the clearness of the treatment.

The book would be incomplete without Part VII (48 pages) by I. Géczy, describing chemical and physical tests. This valuable compilation includes methods to be found in various literary sources and many operational and technological instructions of industrial plants.

The book, being a very valuable addition to the growing number of Hungarian text-books is an important aid also to the research worker engaged in the study of plastics. The abundant and up-to-date information to be found therein secures the interest and appreciation of all Hungarian chemical engineers.

In a book of this extent the expert reader will, probably, disagree on certain data or discussions and is almost certain to find some theoretical or practical problems he would have given a broader treatment or more detailed discussion. Considering the complexity of the material presented, differences in opinion between author and reader may well be expected but the fact that in no instance do these assume a general character is the main merit of the book. The exceptionally small number of misprints, the pleasing finish of the figures, etc. reflect the careful work of the authors and of the editor. The distinguished form and excellent typography of the book are to be attributed to the Publishing House "Tankönyvkiadó".

S. MÜLLER