together elsewhere, but certainly omits almost all the major physical analytical methods, several of which await review. It would be interesting to know just how this particular collection of topics was decided upon.

Individually, the chapters contain much which is of value to those working in the field of steroids. Collectively, they suffer three serious defects. The first is the fact that more than 4 years have elapsed since certain chapters were completed! It is incredible that a book sent for review in 1964 should contain chapters in which post-1959 literature is summarized in a section "added in proof"! This fault leads to a second—the nomenclature employed. The IUPAC nomenclature report on steroids appeared in 1960. Thus, there *is* an internationally recommended system of nomenclature which should have been adhered to in a book appearing 4 years later. Failure to do so has inevitably led to the third defect, namely the index. Obviously, a book of this sort requires most careful and complete indexing. Unfortunately, there is no general formula index and, because of the lack of standardization in nomenclature, it was necessary to include a page listing the variations in the systems of naming steroids. (Testosterone is indexed as 17β-hydroxy-4-androsten-3-one. Based on the Index, it appears under that name on two pages only; as testosterone, on 7 pages; and as 17β-hydroxy-Δ^4-androstan-3-one, on several other pages. The index refers the reader to pages 45, 342, 350, and 377 for this compound, but, in the Reviewer's edition, the compound was not mentioned on these pages. On page 294 the compound is mentioned but is not indexed.)

These faults are all the more unfortunate since there is truly a mine of valuable information hidden in this volume. In particular, the chapter of ultraviolet absorption is to be recommended since it constitutes a vital addition to the earlier review by L. Dorfman. What a pity that this excellent collection of data could not have covered the literature at least until the end of 1962. As it is, this chapter with almost 600 references summarized will still be a great attraction to the steroid chemist. One mistake, however, which will cause problems for the unsuspecting user of the book is the erroneous assignment of a bathochromic shift of 38 mμ for the ultraviolet absorption maximum on introduction of a γ-alkyl substituent into a dienone system.

If the book were up-to-date, the price would not have deterred would-be purchasers. As it is, many may be tempted to wait for the appearance of reviews which cover the recent literature also.

RESEARCH LABORATORIES
SYNTEX, S. A.
APARTADO 2679
MEXICO, D. F.
ALEXANDER D. CROSS

Theoretical Evaluation of Chemical Propellants. By ROGER LAWRENCE WILKINS, Aerospace Corporation. Prentice Hall Space Technology Series. Edited by C. W. BESSERER and FLOYD E. NIXON. Prentice-Hall, Inc., Englewood Cliffs, N. J. 1963. ix + 463 pp. 15 × 23.5 cm. Price, $11.95.

More than half of this book is comprised of appendices. The value of these appendices to the rocketeers is attested by titles: Appendix 1, Thermodynamic Functions of a Monochromatic Oscillator with...Anharmonic Correction"; Appendix 2, "Thermodynamic Properties to Some Atomic Species in the Ideal Gas State"; Appendix 3, "...for Diatomic Species"; Appendix 4, "...for Some Polyatomic Molecules." These tables in a shelf copy will be most valuable to those interested in high temperature gaseous reactions, although the list is necessarily a curtailment of the mass of knowledge that now exits in the world on this subject.

There is less to recommend in the rest of the book. The author proposes to teach those with a knowledge of thermodynamics the methods of calculating thermodynamic information from spectroscopic data and of application of the results to combustion problems, especially those involving the movement of hardware through space. He has gone to great detail, evidently assuming that the prerequisite would be elementary, but the consequence cannot be recommended. Perhaps because of page limitation, the text reads like a catechism rather than an explanation.

Typical on page 12 is the section on Russell-Saunders coupling. In 43 lines the author has confused this relatively simple method by vector summation so thoroughly that the 43 lines in W. S. Moore's third edition of his "Physical Chemistry" (p. 510) are strongly recommended to the neophyte as a means of rising out of the morass.

Nor is the detail consistently applied. On page 164, gas-flow velocity is designated as v, while on page 169 it is called u. Admittedly this duplicity is found in the literature, but it is all the more reason for an explanatory footnote quite different from the one given, which is learned before thermodynamics by every student in first year chemistry or physics.

However, the author is authoritative in Chapter 5, "Performance of Chemical Propellants for Rocket Engines." He limits himself clearly and severely to the theoretical aspects but without discounting the practical aspects of rocketry. He points out that calculation must be made with assumptions either that composition of the gas mixture does not change during expansion through the orifice (frozen flow) or else that equilibrium is established continuously during the expansion (equilibrium or shifting flow) although neither of these conditions actually exist. The prevalent situation (nonequilibrium flow) could be calculated only from reaction rate data, but these are not for the most part available.

When such approximations supplement the deviation from ideal behavior due to turbulence, erosion, and the presence of nongaseous phases, there is temptation to use the added simplifying assumption that the heat capacity of the working fluid is invariant with respect to temperature. The author describes calculation both by use of exact relationships and by the assumption of an average C_p/C_n but he leaves no doubt in the mind of the reader that the latter approximation could only be approved in a fool's paradise. The mistakes of early gunnery need not be repeated in the development of rocketry. If the author impresses others as much in this respect as he has impressed the reviewer, then publication of this book is amply justified.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF TORONTO
TORONTO, CANADA
G. F WRIGHT

Thermodynamik der Irreversiblen Prozesse. Band 8. Fortschritte der Physikalischen Chemie. By ROLF HAASE. Dr. Dietrich Steinkopff Verlage, Darmstadt, Saalbaustrasse 12, Germany. 1963. 522 pp. 15 × 23 cm. Price, brosch, DM 90; ln., DM 95.

Previous writers on nonequilibrium thermodynamics have been theoretical chemists or physicists. Rolf Haase is an active experimentalist as well, and hence the present volume has a distinctive style. Rather than simply writing down equations and deriving mathematical consequences, Haase explores in depth their physical significance and experimental implications. Throughout the volume he gives examples of how fundamental principles are applied to actual experimental situations. Thus "Thermodynamik der Irreversiblen Prozesse" will be of value to those physical chemists who wish to learn the thermodynamic theory of irreversible processes in relation to its experimental verification.

With admirable Germanic thoroughness, Haase starts at the beginning of his subject and proceeds to a logical end. The first chapter contains an excellent presentation of basic principles. In particular, it is worthwhile noting that a whole section is devoted to the concept of heat transfer in open systems. The second chapter is concerned with homogeneous systems. Here thermodynamic coupling of chemical reactions is examined critically, and relaxation processes are studied. In the third chapter, nonequilibrium phenomena in heterogeneous systems are considered. Electrokinetic effects, thermomechanical effects, and thermo-osmosis are given special emphasis. In the fourth chapter, continuous systems are treated. Among the topics discussed are isothermal diffusion, thermal diffusion, thermocells, external gravitational and electromagnetic fields, and anisotropy. The fifth and final chapter is concerned with the theory of stationary states. The chapter closes with a brief qualitative section on stationary states in biological systems.

Perhaps the most important criticism of the volume is that Haase does not mention the paper by Coleman and Truesdell (*J. Chem. Phys.*, **33**, 28 (1960)) which has occasioned considerable interest. Some of the discussion of the Onsager reciprocal relations and the phenomenological relations would have been improved if he had taken their conclusions into account. Other-

wise "Thermodynamik der Irreversiblen Prozesse" is a book that this reviewer wishes he could have written himself. Haase is a master teacher who has given the physical chemist a first-rate introduction to the thermodynamics of irreversible processes. It is to be hoped that the linguistic laziness of the English-speaking world will not impede this book in achieving the high reputation it truly deserves.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF KANSAS
LAWRENCE, KANSAS
RICHARD J. BEARMAN

The Chemistry of Cationic Polymerization. Edited by P. H. PLESCH. Pergamon Press, The Macmillan Co., 60 Fifth Ave., New York 11, N. Y. 1964. 728 pp. 16 × 24 cm. Price, $30.00.

The concepts and experimental information available for cationic-catalyzed polymerization have increased in a spectacular fashion in the past twenty years. A specialized book of this kind, consisting of contributed chapters amounting to 712 pages, is an indication of the interest in this general subject.

There is considerable overlap in many of the chapters which the editor has clearly recognized, and rather than disrupt the flavor of a chapter by an expert, he has chosen to allow some duplication and insert comments and cross-references. One could always quarrel with the verbosity of some of the chapters, but it is inevitable in a specialized book of this type.

There are two groups of people to whom this book will be very useful: (1) macromolecular chemists who are interested both in synthesizing large molecules and mechanisms of polymerization; and (2) a small "hard-core" of researchers throughout the world working on the details of mechanisms of catalyzed-cationic polymerization.

The first two chapters

I. "Carbonium Ions," by M. L. Burstall (Battersea College of Technology, London) and F. E. Treloar (University of Malaya)

II. "Organic Reactions Related to Cationic Polymerization," by M. L. Burstall

are background material to review the chemistry of ion pairs in solution. This may have seemed advisable, but this reviewer rather questions whether it has been worthwhile, because by necessity these chapters cover details of intermediates and transition states, etc., which are also discussed by authors in individual chapters. Perhaps this repetition may be helpful to some readers.

The third to eighteenth chapters are listed here for information:

III. "A Comparison of the Radical, Cationic and Anionic Mechanisms of Addition Polymerization," by P. E. M. Allen (University of Birmingham) and P. H. Plesch (University of Keele)

IV. "Isobutene," by P. H. Plesch

V. "Aliphatic Mono-olefins Other Than Isobutene," by C. M. Fontana (Celanese Corporation of America)

VI. "Styrene," by Professor A. R. Mathieson (University of Northern Nigeria)

VII. "Aryl Olefins Other Than Styrene," by S. Bywater (National Research Council, Ottawa)

VIII. "Polyenes," by W. Cooper (Dunlop Rubber Co.)

IX. "Vinyl Ethers," by Professor D. D. Eley (University of Nottingham)

X. "Epoxides," by A. M. Eastham (National Research Council, Ottawa)

XI. "Cyclic Oxygen Compounds Other Than Epoxides," by J. B. Rose (I. C. I. Plastics Division)

XII. "Miscellaneous Oxygen Compounds," by A. Schrage (Rexall Chemical Co.)

XIII. "Sulphur Compounds," by J. Lal (Goodyear Tire and Rubber Co.)

XIV. "Nitrogen Compounds," by G. D. Jones (Dow Chemical Co.)

XV. "Co-polymerization," by R. B. Cundall (University of Nottingham)

XVI. "Cationic Reactions of Polymers and Cationic Graft Polymerization," by Professor G. Smets and M. van Beylen (University of Louvain)

XVII. "Cationic Polymerizations Induced by High Energy Radiation," by S. H. Pinner (BX Plastic Ltd.)

XVIII. "Experimental Techniques," by P. H. Plesch

This reviewer would disagree occasionally with points of view raised, but in a book of this sort this would be unavoidable. Research workers in specific areas of cationic polymerization will want this book as part of their personal library; certainly every macromolecular chemist will need this book for reference referral.

The editor is to be complimented for completion of a difficult task.

OFFICE OF THE DEAN OF SCIENCE
POLYTECHNIC INSTITUTE OF BROOKLYN
BROOKLYN, NEW YORK 11201
C. G. OVERBERGER

The Rare-Earth Elements. By D. N. TRIFONOV, Institute of the History of Sciences and Technology of the Academy of Sciences of the U.S.S.R. The Macmillan Co., 60 Fifth Ave., New York, N. Y. 1963. xv + 128 pp. 14.5 × 22 cm. Price, $3.50.

It is indeed unfortunate, as the author states, that "the number of review articles and books on the rare-earth elements in Russian is very small." This circumstance has led him to prepare a little volume of facts gleaned from out-of-date Russian works and some, but obviously not all, of the English language reviews of the subject. His intent was to furnish the Russian student of chemistry with "an account which is lively, easily-intelligible and informative, of the long and extremely involved story of the discovery of these elements, their properties, the methods for their separation, the present state of problems regarding them, and some prospects of future developments in this branch of chemistry." The result of Trifonov's abbreviated and cursory interpretation of existing accounts, and a detectable amount of Russian bias in assessing the contributions of the various workers whose names are cited, is extremely disappointing—in that he has fallen miserably short of his stated goal. Only the history of their discovery and the early chemistry of the rare earths have been treated adequately. Modern ion-exchange methods for separating rare earths have been passed over lightly, and solvent extraction techniques have not been discussed at all.

Interpretation and translation of English works to Russian, and literal retranslation of the result to English by an Indian translator, with inadequate final editing, have contributed to the inclusion of an appalling number of typographical errors, obvious mistakes, and garblings of radiochemical symbols.

Owing to the many mistakes, various omissions, perpetuation of many common misconceptions (that the ion-exchange method is unsuitable for producing large quantities of pure rare earth materials, that rare earth elements are extremely difficult to obtain in the metallic state, that the cost of rare earth oxides and metals is prohibitive, that dilute nitric acid acts only on metallic cerium, etc.), and a complete lack of specific references to the source of data cited, this book is not to be recommended—either to the student, whom it will confuse, or to the expert, whom it will disappoint.

IOWA STATE UNIVERSITY
AMES, IOWA 50012
JACK E. POWELL

Consecutive Chemical Reactions. By N. M. RODIGUIN and E. N. RODIGUINA. Translated from the Russian by Scripta Technica, Inc. D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. 1964. ix + 136 pp. 15.5 × 23.5 cm. Price, $5.00.

One day last March, I (= this reviewer) received from Mount Olympus a curiously composed proposal that I review a small book on the mathematical theory of chemical reaction kinetics—by Dr. and Mrs. Rodiguin of Russia—for the American Chemical Society's most celebrated Journal. To have rejected the proposal on any grounds whatever—ideological, temperamental, or financial—would have invited certain persecution by all the gods and the Society too. The last time I was persecuted by the ACS was when I was falsely accused of having taken advantage of one of their "inexperienced" employees, a very pretty Chinese girl, in San Francisco. (She didn't even give me a second look.) To avoid another such experience, here I am. Not having ever been much corrupted by Aristotle, Gibbon, Freud, Marx, or the ACS, I can hope to give a pleasantly objective estimate of the book's virtues and sins.