selection of new biocompatible surfactants, more specifically designed for emulsifying fluorocarbons.

A solid chapter by *N. S. Faithfull* discusses the potential of fluorocarbon emulsions in medicine and research. The author's reminder that it is the carrier's oxygen delivering capacity rather than its oxygen dissolving capacity which is important, is welcome. He then emphasizes that the potential of fluorocarbon emulsions goes considerably beyond that of a substitute for blood. Microcirculatory support of the myocardium and central nervous system, use in radiology or for radiosensitization of hypoxic tumors, for organ preservation or during cardiopulmonary bypass, or percutaneous transluminal coronary angioplasty, treatment of respiratory failure, and stimulation of killer macrophages are among the most promising avenues that are being explored. The reader may regret that some of these applications are not discussed in greater depth.

K. C. Lowe left for himself the difficult task of summarizing the biological assessment of fluorocarbon emulsions, which is treated in a meticulous, detailed manner. Particular consideration is given to the uptake of emulsion components into lymphoid tissues and the reticuloendothelial system, and to the consequences these may have on immune defence in the recipients. Unfortunately the greater part of the available data still concern the early fluorocarbon-poor and Pluronic F-68 containing emulsions, Fluosol-DA and Fluosol-43. It will nevertheless be of great use by providing the reader with extensive information and numerous protocols which should prove helpful for evaluating the newer emulsions. The need for improved biocompatibility with respect to Fluosol-DA is indeed high-lighted.

Chapter 8, by *G. M. Vercellotti* and *D. E. Hammerschmidt*, reviews the clinical studies that have so far involved fluorocarbon emulsions. Again these studies concern *solely Fluosol-DA*; the data analyzed highlight the side effects and limitations of this particular preparation. These are by no means representative and cannot be extrapolated to other fluorocarbon emulsions. The authors then discuss the possible mechanisms for the adverse reactions noted with Fluosol-DA, and show that they can be assigned primarily to complement activation by Pluronic F-68, the main surfactant used in this preparation. As a result they call for the development of emulsions with a lower ability to activate plasma complement.

On the whole, *Lowe*'s book, in spite of some omissions (the chemistry of modified hemoglobin, for example) and repetitions (the compositions of Fluosol-DA is given no less than three times), inevitable in such a multi-author enterprise, reaches its objective. It is timely and useful—useful as it summarizes a considerable amount of recent information in a relatively small, compact volume—timely in view of the increasing demand for substitutes for blood, triggered by increased difficulties of transfusion, and also because the decisive breakthroughs that have recently been achieved, especially in the fluorocarbon approach, should lead to new preparations now becoming available for research.

There are few typographical errors in the text; the same is unfortunately not true of the chemical formulas and equations, which sadly appears to be a common fault in medically-oriented books.

Pierre Vierling
Department of Chemistry
University of Nice-Sophia Antipolis (France)

Electrons in Solids: An Introductory Survey. By *R. H. Bube*. Academic Press Inc., San Diego 1988. xiv, 315 pp., bound, $ 39.50.—ISBN 0-12-138552-3

The book is intended as an introductory survey for students with a background in materials science or other engineering disciplines. This is explicitly stated by the author in the preface to the first edition. The second edition has been updated in some chapters by including recent developments, and an additional chapter on "sample problems" has been included in the appendix.

The presentation is clear and supported by very good illustrations. Since the reader is not expected to have a knowledge of electrodynamics, quantum mechanics or basic solid state physics, the author has to cover a lot of ground before he can present the facts on various properties of solid state materials. In the first chapters he therefore has to give a short description of the above mentioned basic physics. After having discussed the general properties of waves in Chapters 1 and 2, he continues by describing lattice waves and light waves in Chapters 3 and 4. The usual examples of quantum mechanics are described in Chapter 5, and in the next two chapters the simplest models of solids are presented, namely the free electron model and the tight binding description. In the second half of the book we find the main topic, with chapters on optical, electrical and magnetic properties, and an additional chapter on junctions between different materials.

The treatment contains a good mixture of phenomenological descriptions, formal presentations of basic formulas, and comparison with experimental results. Nevertheless, I have the feeling that a student reading Chapter 4, for example, where on 14 pages the Maxwell equations are presented, may have difficulties in really understanding these basic equations. A good list of further references including textbooks on this subject should at least have been provided. The same problem for the reader might also arise with the topics in the other six introductory chapters.

The second half of the book discusses a quite extensive list of properties of the solid state, and again the clarity of the presentation is to be admired. The chapter on optical properties presents an overview of the various absorption processes. Unfortunately, there is no discussion on new developments, e.g. on various aspects of laser physics. The next chapter on electrical properties discusses the basic relaxation mechanism in semiconductors, and a few pages are devoted to effects in superconductors. A topic of special interest for students in engineering science is presented in the chapter on junctions between various materials. The new and interesting properties of quantum wells and superlattices are only briefly touched on, and there is no discussion of the quantum Hall effect, for example. A final chapter on magnetic materials presents some basic facts on diamagnetism and ferromagnetism, and also includes a discussion of new magnetic materials. Looking through these chapters the question again arises whether a student in the engineering disciplines will really obtain a basic understanding of the various phenomena. I therefore suggest that further references to textbooks and original literature should be included at the end of each chapter.

The appendix includes useful formulas, as well as the above mentioned discussion of problems, which I think are very helpful for students. The list of problems at the end of the book is also attractive.

The book can be recommended for undergraduates with an engineering background, as a suitable introductory text on solid state physics. However, in teaching such a course one should give the students further material for background reading in the various topics.

Helmut Büttner
Physikalisches Institut
der Universität Bayreuth (FRG)

Optical Nonlinearities and Instabilities in Semiconductors. Edited by *H. Haug*. Academic Press, San Diego 1988. xi, 440 pp., bound, \$ 65.—ISBN 0-12-332915-9

The investigation of optical nonlinearities in semiconductor materials and devices has recently become a field of rapidly increasing interest, mainly due to possible applications in optical data processing. Most important for these applications are the so called "resonance enhanced" nonlinear optical processes, which occur when the photon energy of the optical field is close to an electronic resonance of the semiconductor material, e.g. the fundamental band edge. According to the editor's statement in the introduction, the present book attempts to bring together all the investigations of the resonance enhanced nonlinear optical properties of semiconductors and their manifestation in optical instabilities. In the reviewer's opinion, this attempt has been highly successful.

The book contains 16 independent review articles on different, partly related topics, written by different authors, together with an introduction by the editor which contains some historical comments and a brief summary of the definitions and concepts employed to describe the nonlinear effects. The list of authors includes many leading scientists representing some of the most active laboratories in the field.

Most of the articles are devoted to optical nonlinearities due to electronic processes in semiconductors, including free carrier effects such as band filling, band gap shrinkage and inter-band absorption, as well as excitonic nonlinearities; however, thermally induced optical nonlinearities are also discussed (e.g. the contribution by *Wherret, Walker* and *Tooley*). Special attention is also paid to nonlinear phenomena in electronic systems with reduced dimensionality, as in semiconductor quantum well structures, and to optical nonlinearities in semiconductor devices, in particular semiconductor lasers.

The combination of theoretical and experimental work is one of the special features of this book. Fortunately, experiment and theory are not treated separately; instead, a close connection is maintained throughout the book, by means of jointly written reports, and careful arrangement of the respective papers.

The theoretical contributions cover fundamental topics such as the microscopic theory of optical band edge nonlinearities (*Haug*), the theory of dense nonequilibrium exciton systems (*Schäfer*), the nonlinear optical properties of semiconductor quantum wells (*Chemla, Miller* and *Schmitt-Rink*), including electric field effects as well as more device orientated problems such as the theoretical description of optical instabilities in semiconductors (*Koch*).

The experimental data collected in the present book cover bulk phenomena in different II–VI compounds, including semiconductor doped glasses (*Klingshirn, Peyghambarian* and *Gibbs*), exciton and biexciton processes in III–V (*Ulbrich*) and II–VI semiconductors (*Levy, Hönerlage* and *Grun*), optical phase conjugation (*Claude, Chase, Hulin* and *Mysyrowicz*), electronic transport (*Mahler, Kuhn, Forschel* and *Hillmer*), and some of the most recent results on optical nonlinearities in quantum well structures (*Chemla* et al.; *Miller* et al.; *Peyghambarian* et al.).

Device applications are described in several reports; in particular, self-electro-optic effect devices (SEED) based on electric field induced nonlinearities in quantum wells (*Miller* et al.), as well as bulk semiconductors (*Jäger* and *Forsmann*) are discussed. Finally, semiconductor lasers—which are essentially nonlinear optical devices—are considered in detail, including optical bistability in laser amplifiers (*Adams, Westlake* and *O'Mahony*), semiconductor lasers (*Harder* and *Yariv*), and higher order instabilities in semiconductor lasers, including chaotic emission (*Shore* and *Rozzi*).

The book provides a comprehensive overview of the basic physics and device applications of resonance enhanced nonlinear optical phenomena in semiconductors at a high scientific level. It is mainly addressed to research students and active research workers in this area, and for them this book will be indispensable.

Ernst O. Göbel
Fachbereich Physik
der Universität Marburg (FRG)