namely those who have specialized in "narrow" fields. For example, if one has limited knowledge of molecular physics (as has this reviewer) or semiconductors, this book offers a good, quick introduction and survey of the subject(s). On this positive note, let me briefly skim the highlights of *Modern Physics*.

Modern Physics presents a study of elementary phenomena in nuclei, atoms, molecules, and solids in the light of quantum mechanics. The first chapter gives a historic overview of experiments and results that led to the discovery of the atom, its structure, mass, and charge, at the same time describing elementary properties of particles composing atoms and nuclei. Chapter 2 deals with the behavior of assemblies of particles, introducing the ideal gas law, the Maxwellian distribution of kinetic energies and velocities of these particles, and the Boltzmann distribution.

Since classical mechanics and electromagnetic theory could not explain all the properties of atoms, it became apparent that particles show some different phenomena in behavior that could only be understood by means of quantum physics. Chapter 3 describes the ways that led to modern theories of quantum physics, starting with the explanation of black body radiation, the photoelectric effect, the discrete nature of atomic spectra, electron diffraction in crystals and other phenomena that all confirmed the dual nature of subatomic particles and electromagnetic radiation. Chapter 4 gives the mathematical background of quantum mechanics. It introduces the Schrodinger equation and shows how it can be applied to describe and explain the different physical phenomena of the world of modern physics. In Chap. 5, the Schrodinger equation is solved for the hydrogen atom and the quantum numbers are introduced. Applying Pauli's principle of exclusion, the electronic structure of atoms is then explained. Chapters 6 and 7 deal with chemical bonds in the light of wave mechanics–the molecular binding and spectra, the ionic bonds, the metallic bonds, and energy bands in solids.

Next, in Chap. 8, the theory of binding and energy bands is used to explain selected properties of solids, such as the electrical conductivity in metals, the thermal conductivity in solids, and the magnetic properties of materials. Chapter 9 explores how imperfections and impurities in crystals affect the physical properties of solids, and the next chapter makes use of the theories that have been introduced to study semiconductors.

The last two chapters are devoted to nuclear physics. The quantum physics explanation of natural radioactivity, nuclear reactions, and nuclear forces is first given, while Chap. 12 deals with the applications of nuclear reactions and radionuclides in practice and with the interactions of radiation with matter.

J. N. Anno received his PhD in physics from The Ohio State University in 1965. Since 1953, when he joined the staff of Battelle Memorial Institute, Columbus Laboratories, he has been involved primarily in nuclear-oriented research and development. He was operating supervisor of the Battelle Research Reactor from 1955 to 1960, then continued later research in the effects of radiation on materials, covering a broad spectrum of topics from secondary electron emission to radiation-induced desorption. In 1970, Dr. Anno joined the nuclear engineering faculty at the University of Cincinnati, where he is now teaching and performing research primarily in the areas of nuclear physics, radiation effects, and fusion. He is also president of Research Dynamics Incorporated, a small research and development corporation.

Thermal Properties of Foods and Agricultural Materials

Author	N. N. Mohsenin
Publisher	Gordon and Breach, Science Publishers, Inc. (1980)
Pages	407
Price	$53.00
Reviewer	Clifford J. Cremers

This book has four major parts: basic heat transfer theory as applicable to problems encountered in dealing with foods and agricultural materials, methods for determining thermophysical properties, applications to food heat transfer problems, and finally a large appendix of property values.

There is nothing particularly profound about the material in this book. It is taken piece by piece from the literature with a stress on the data. Where appropriate, there are also brief descriptions of the original investigator's techniques. Very little space is devoted to critically reviewing the data or the experiments from which they came.

There are some discrepancies in the cited references, and a number of typographical errors and poorly labeled figures are apparent. In the selection of subject matter, it appears odd that there is no space devoted to freeze-dried materials. This type of food processing is energy intensive and design predictions depend heavily on having accurate property values.

Most nuclear engineers would not find this book of much help unless they were directly involved in the food processing industry.

Clifford J. Cremers is presently professor and chairman of the Department of Mechanical Engineering at the University of Kentucky, where he has been since 1966. Previous to that he was on the faculty at the Georgia Institute of Technology, where he went after receiving a PhD from the University of Minnesota in 1964. He teaches courses across the spectrum of the thermal sciences and has published over 60 papers in heat transfer in plasma systems, heat transfer in frost layers, and thermophysical property measurement.

A User's Guide to Vacuum Technology

Author	John F. O'Hanlon
Publisher	Wiley Interscience Publishers, New York (1980)
Pages	402
Price	$24.95
Reviewer	Clifford J. Cremers

This book is directed toward the typical user of vacuum systems, as its focus is on the understanding, operation, and selection of equipment for process work over a large range of pressures. It seems to contain a considerable amount of information from the author's own experience and in addition has a large number of cited references, many of which are quite current.

The book has four major sections. The first dwells on the dynamics and thermodynamics of gases at low pressures. Here the terminology and basic equations of kinetic theory are used to develop expressions for gas transport phenomena and fluid flow in the free-molecule regime. The treatment is not sophisticated and serves as an excellent introduction for the uninitiated.

The next section is on pressure measurement in vacuum systems. This includes an excellent chapter on different kinds of pressure sensors and the errors inherent in the use of each. Here one can learn the operating details of the various low pressure gauges and the pitfalls that lie in the path of applying each.

The concluding two chapters of this section explain the use of residual gas analyzers (RGAs) and the interpretation of the data obtained with them. As a frequent user of vacuum systems, including RGAs, I was well aware of the utility of the latter for leak detection. However, I was amazed to find that there is much detective work that one can do with RGAs to seek out reasons for the occurrence of less than pristine conditions in a vacuum system.

The section on materials deals mainly with their behavior under vacuum and there is a particularly valuable discussion of the problems of gas efflux due to vaporization, thermal desorption, diffusion, permeation, and desorption stimulated by charged particles incident on solid surfaces.

The final section of the book is concerned with the production of vacuums. One chapter deals with various kinds of mechanical pumps including the relatively new turbomolecular type. Here the author provides good physical insight to the limitations of the pumps, in particular their maximum pumping speed and ultimate pressure. The discussion then proceeds through two chapters on the various kinds of entrainment pumps that are used for achieving high vacuums.

This last section ends with three chapters on high and ultra-high vacuum systems plus systems for high gas flows. Here the very practical aspects of component selection and system testing are discussed in sufficient detail that the typical user should, without too much difficulty, be able to assemble a vacuum system appropriate to his needs without seeking outside help. I think the rather complete compilation in the appendixes of property and other appropriate data will be quite useful to a user, either in designing special equipment to be used in the vacuum system or when troubleshooting it later on.

I have worked with a number of vacuum systems in the past and have designed and used them without the benefit of having a knowledgeable colleague. I know how many hours one can dissipate in trying to track down a simple leak or gas efflux problem. I think this user's guide is going to be of considerable help to me in the future and I recommend it to any other engineer or scientist who suddenly finds himself in the position of needing a speedy education in the design and use of vacuum systems.

Clifford J. Cremers is presently professor and chairman of the Department of Mechanical Engineering at the University of Kentucky, where he has been since 1966. Previous to that, he was on the faculty at the Georgia Institute of Technology, where he went after receiving a PhD from the University of Minnesota in 1964. He teaches courses across the spectrum of the thermal sciences and has published over 60 papers in heat transfer in plasma systems, heat transfer in frost layers, and thermophysical property measurement.