drifted into materials science, it makes me somewhat sad to see others in this field learn my valuable "secrets" in transport phenomena.

Fluid mechanics, heat transfer (including radiation), and mass transfer are all treated. Concepts are introduced through specific problems; the general differential equations are then derived and applied to more examples. Many of these examples and the additional unsolved problems at the end of each chapter are of special interest to the metallurgist. Also discussed are flow from ladles, casting, transport in packed beds, vacuum production, and radiation in furnaces. Although a few topics have been neglected, one cannot really expect an introductory text with such a broad scope to cover every relevant subject in depth.

The authors are to be commended for the service they have performed for the materials science community.

William R. Wilcox
Chemical Engineering and Materials Science Depts.
University of Southern California
Los Angeles, California

Fundamentals of Food Engineering, 2nd Edit., S. E. Charm, Avi Publishing Company, Westport, Connecticut (1971). 629 pages.

This is the best book on the subject of engineering principles and concepts utilized in the food processing industry. The material is very well presented and easily read. The approach of presenting a concept and carrying through with its utilization in industrial processes makes for some interesting reading. Scores of formulas for solving various problems encountered in food processing and examples of solved problems utilizing these formulas make this book a very handy reference for a practicing engineer in the food industry. The book is copiously referenced and a reader wanting to know more about the background and rationale of the subjects presented can readily find the source.

The chapters dealing with material and energy balance, evaporation, distillation, extraction, heat transfer, mass transfer, and centrifugation and filtration are treated no differently from those in a standard undergraduate chemical engineering textbook; however, example problems are derived from places in which these unit operations are utilized in the food industry. The chapter on fluid flow puts together the principles of viscometry and analysis of problems involving the flow of non-Newtonian food fluids. Chapters dealing with problems unique in the food industry include ones on thermal process evaluations (sterilization of canned foods), freezing and thawing of foods, dehydration, freeze drying, strength of materials and equipment, and kinetics of biological reactions. Tables in the Appendix provide an excellent source of data on thermal and physical properties of foods.

If I were to find fault with the book, it would be that in the author's attempt to provide mathematical solutions to most problems encountered in food processing, in too many instances he merely presented equations without discussing the basis or limitations of these equations, thus conveying the impression that any problem can be solved by simply plugging numbers into an equation. This inadequacy is offset, however, by the book's excellent list of references, and a cautious engineer can always refer to the original source.

For a book written for both food scientists and engineers, this is much too advanced for the former but would be useful to an engineer working in the food industry.

Romeo T. Toledo
Food Science Department
University of Georgia

Thin Liquid Films and Boundary Layers: Special Disc. of the Faraday Society, No. 1, 1970, Academic Press, New York (1971). 269 pages.

This book consists of the papers presented at a special discussion symposium on *Thin Films and Boundary Layers*, held at the University of Cambridge in September, 1970. This meeting was well attended by investigators from many countries who are actively working in this area of research. The general discussion and comments of various participants at the end of each session constitute a very interesting and stimulating part of this book.

Although the book was published in 1971, it remains the most recent book providing a comprehensive review on thin films and boundary layers. Investigators in chemical engineering and related professions may find this book extremely helpful in bridging the basic research with many applications such as foams, emulsions, flotation of minerals, colloid stability, and boundary lubrication. The following is a brief summary of papers grouped around each of these applications.

The first three papers are related to the mechanism of bursting of soap films, the change in film thickness due to a rapid change in the temperature of the surrounding atmosphere, and the effect of electrolytes on nonionic surfactant films. The results presented have important implications for foams. The next three papers include a discussion by Haydon and his co-workers on composition and energy relationships for thin lipid films and the chain conformation in monolayers at liquid-liquid interfaces. Sonntag et al. have presented their studies on the equilibrium distance, contact angle, and formation velocity of black films between oil droplets which are separated by an aqueous film of surface-active agents. The experimental determination of the critical thickness of liquid films on various solid surfaces described by Padday clearly indicates the need for theoretical development in this area. Adlfinger and Peschel discussed the disjoining pressure of thin layers of organic liquids between fused silica surfaces.

Boundary layer viscosity of polydimethylsiloxane liquids and the structure of Graphon/liquid interfaces were discussed respectively by Deryaguin et al. and Ash and Findenegg. The next two papers are of considerable interest in relation to froth flotation. The first describes the contact between a gas bubble and a solid surface and the next one reports the interfacial energies of clean or fatty acid deposited mica surfaces.

There are three interesting papers from the laboratories of Ottewill, Lyklemia, and Dukhin on the measurements of forces between colloidal particles and the electrochemistry of boundary layers. The next three papers report the studies on the structure of water at interfaces in systems such as polystyrene lattice, lamellar mesomorphic phases, vermiculite clay, and silicates, using nuclear magnetic resonance and neutron scattering techniques.

The last five papers in this book are relevant to lubrication. They include a study on the viscosity of various liquids in quartz capillaries, the effect of surfactant on thinning of oil films between solid surfaces, and the mechanical properties of very thin films.

In this reviewer's opinion the book illustrates the most recent developments in basic research on surface phenomena with emphasis on applications and is a most welcome addition to the library of any investigator working in the area of interfacial phenomena and its application to foams, colloids, flotation, and lubrication.

D. O. Shah
Depts. of Chemical Engineering & Anesthesiology
University of Florida
Gainesville, Florida 32611