explanations do not have the complete agreement of the polymer science community or the majority of the membrane community.

Finally and perhaps most disappointing was the incomplete discussion of the processing involved in forming the so-called prism α membrane or other competitive gas separation membranes. Indeed, since both of the authors know the details of such processes intimately they could have offered a wealth of details on what is done and why it is done in the actual spinning, drying and post treatment of these membranes. I would have found this "how to" discussion more useful than the highly speculative explanations of the *effects* of the process on the substrate and skin morphology. I had expected that this book would be the "inside story" of how the membranes are really made with some treatment of the considerable art involved in formulating dopes and balancing the processing variables to arrive at the graded density morphology that characterizes the prism α structure. It does not do this.

William J. Koros
Dept. of Chemical Engineering
University of Texas at Austin
Austin, TX 78712

Fluctuational Effects in the Dynamics of Liquid Crystals

By E. I. Kats and V. V. Lebedev, Springer-Verlag, New York, 1994, 170 pp.

This is a highly specialized monograph dealing with the fluctuation dynamics of liquid crystalline systems about their equilibrium state. Although primarily a book written for theoretical physicists by theoretical physicists, it may have limited appeal to the chemical engineering community as well.

The authors focus very narrowly on the near-equilibrium dynamics of nematic, smectic, columnar and chiral liquid crystalline phases. They discuss these phases only very briefly; a much more detailed introduction to liquid crystals is contained in the recently revised text by de Gennes and Prost (*The Physics of Liquid Crystals*, 2nd ed., Oxford, New York, 1993). However, Kats and Lebedev take great care in setting up the governing fluctuating hydrodynamic equations, discussing both the derivation of the reversible terms arising from Poisson brackets and the irreversible terms involving transport coefficients. This presentation is somewhat more detailed than the corresponding material in de Gennes' and Prost's text, but is not as elegant as in the classic article by Martin et al. (*Physical Review A* **6**, 2401, 1972).

After setting up the appropriate continuum description for each type of liquid crystal phase, the authors embark on a very careful analysis of fluctuation effects. In particular, they discuss the role of fluctuations in renormalizing the elastic constants and the linearized transport coefficients, such as the various viscosities that characterize liquid crystalline phases. A nice feature of the monograph is that all of these different phases are treated within the same theoretical framework. The formalism, however, is a bit heavy at times. The authors adopt the functional integral representation of stochastic dynamics due to de Dominicis and Janssen, but have a nonstandard way of dealing with the functional Jacobian that enters the theory and preserves causality. In my opinion, the use of Fermi fields and associated Grassmann algebra to represent the Jacobian is a bit of an overkill for the problem at hand.

I suspect that the technical details of this monograph may be inaccessible to many chemical engineers. In particular, there are probably very few engineers with a sufficient background in quantum field theory to fully appreciate the calculations outlined in this book. Nevertheless, the conclusions are potentially of importance to engineers: thermally excited fluctuations in liquid crystalline systems can lead to unusual *linear* elastic and dissipative properties. For example, if one is to understand why certain of the viscosity coefficients of smectics are larger than others, these fluctuation effects must be considered. On the other hand, engineers are often concerned with the processing of liquid crystalline materials under conditions where *nonlinear* rheological behavior is the norm. The text makes no attempt to address such far-from-equilibrium dynamical behavior.

Overall, I strongly recommend this monograph for that rare engineer who has a strong background in theoretical physics and who needs to understand in detail the linear response properties of liquid crystalline systems. Chemical engineers not in this category will probably benefit more from the broad coverage in the text of de Gennes and Prost or from a rheology text that has some discussion of liquid crystalline systems, such as that of Larson (*Constitutive Equations for Polymer Melts and Solutions*, Butterworths, Stoneham, MA, 1988).

Glenn H. Fredrickson
Chemical & Nuclear Engineering Dept.
University of California, Santa Barbara
Santa Barbara, CA 93106

Reduced Kinetic Mechanisms for Applications in Combustion Systems

Edited by N. Peters and B. Rogg, Spring-Verlag, New York, Lecture Notes in Physics, Monograph 15, 1993, 360 pp.

This monograph describes the status of a reaction-engineering approach developed almost solely by mechanical engineers: reducing large sets of elementary reactions into minimum sets of species and global combustion reactions. Almost no chemical engineers work in this specific area, even though many chemical engineers are active in combustion research (e.g., four sessions at the 1994 AIChE Annual Meeting). On the other hand, the approach is relevant to chemical processes from steam cracking to plasma processing to catalysis.

A survey of the technique and its applications is reported, growing out of a series of mechanism-reduction workshops beginning in 1987. Contributors started with a common 87-reaction set for gas-phase combustion of C_1 to C_3 hydrocarbons and methanol. (Note that "mechanism" is used in this context to mean the set of reactions, not a specific sequence of steps by which an overall reaction takes place.)

The book first describes this reaction set, the transport models, and laminar flame-speed data for comparisons. Then, it divides its cases by separately considering simple premixed flames and counterflow diffusion flames. For each flame type, mechanisms are reduced and calculations are analyzed for fuels of increasing complexity—H_2, H_2/CO, CH_4, C_2H_6, C_2H_4, C_2H_2, C_3H_8, and CH_3OH. NO_x chemistry is also considered briefly.

The methods are like those used in developing Lindemann, Langmuir-Hinshelwood-Hougen-Watson, Monod, or Michaelis-Menten rate expressions. A