pling and analytical techniques and elimination of pollutants. Obviously, it is not possible in 367 pages to cover every subject in great depth; however, because of the breadth of coverage, this book could make an excellent text for an introductory survey course in *pollution control*. It could also serve as a starting point for someone just becoming involved in pollution control, although in that respect it is lacking in many of the basic literature references. Six chapters contained no bibliography whatsoever.

ROGER R. LESIEUR
United Technologies Corporation
Power Systems Division

Rheometry, K. Walters, Wiley, New York (1975) 278 pages $32.00.

This is a timely occasion for a book on rheometry: the three decades of serious activity which we have observed since the advent of the modern subject by Weissenberg, Reiner and Rivlin might be described as one of toying with infinitesimal deformations, one of development of adequate instrumentation and now one of vigorous analytic and experimental work. Professor Walters' book brings all this together in a conservative and careful manner: conservative in that the only experimental tools which are discussed and recommended are those which have been proven useful; careful in that the notation is very clear, the derivations are complete and lucid and errors of fact and of typography appear to have been eliminated with a substantial devotion to detail.

The book is not a text for teaching rheology nor a development of molecular constitutive equations as the jacket flap might imply but it is a valuable reference for both students and practitioners of rheology. The important rotational shearing flow geometries are thoroughly analyzed with careful attention to assumptions in the derivations and to such error sources as inertial, edge and end effects. The many years of productive experience which the author has enjoyed with the Weissenberg rheogoniometer assert themselves with dignified authority and clarity. Both steady state and oscillatory sinusoidal test methods are described in detail and the treatment of instrumental resonance effects is lucid. There is no other compilation of all of this which is of comparable quality.

The reader also deserves to know the important limitations of the book and there are several. The experimental difficulty of resolving the phase angle during forced oscillations is barely mentioned. There is no discussion of transient tests other than sinusoidal —such as the "start-up" or "stress relaxation" modes. The fact that the cone-and-plate geometry cannot satisfy the stress equations of motion for nonlinear fluids when a steady shearing motion is assumed is noted on p. 46 but, for inexplicable reasons, this geometry is later concluded to be superior to the parallel plate geometry which is entirely free of this conceptual defect. An excellent analysis of secondary flows in the cone-and-plate device, published by Turian in 1972, has also been omitted with reference given instead to an earlier analysis which is really much less satisfactory.

The use of capillary instruments to infer material properties is discussed much more superficially than are the rotational devices. Capillary measurements generally extend the attainable range of experimental results by more than two orders of magnitude and so their use is of very great pragmatic importance. That this is so is clear from the figure reproduced from the work of Meister and Biggs but the significance of this fact is not noted in the text. In the case of extrudate swell the excellent papers by Graessley and Tanner are really not considered in sufficient detail for the reader to appreciate their utility. The capillary tube is the most widely used rheometer in industry and its real strength is lost, in the view of these reviewers, in an exhaustive discussion of pathological results which are not of very great importance.

On the subject of extensional flows Professor Walters' conservative stance is to emphasize steady-state results perceptively and in detail. This is good but also needed is a lucid discussion of what can be done at much higher deformation rates in unsteady state experiments. These are mentioned briefly and sensitively but the reader is not exhorted to proceed as vigorously with such studies as may be desirable if we are to understand industrial operations such as film blowing and fiber spinning.

Omitted are a large variety of empirical procedures for inferring material properties as well as any mention of work of thixotropic systems.

Professor Walter's subtle Welsh humor is present, though not as frequently as we might have preferred. Both of us must admit to failing Professor Walters' rheological Rorschach test: the pictures in Figure 3.3 remain as much of a mystery after a month as when the book was first received. After the usual exhortations concerning material indifference he notes (p. 42) with less than profound insight that the standard "broomstick" experiment (stretching of a cylindrical rod) is an extensional flow regardless of whether the whole apparatus is fixed in the laboratory or rotating on a giant turntable. This is followed by "it is not immediately clear how such a flow can be realized in the laboratory." Nor, might one add, why! Surely Equation 3.79 was inserted merely to determine whether or not the reader was awake.

In summary, this book may contain a number of omissions but very few errors. It is by far the best book available on the subject.

ARTHUR B. METZNER
University of Delaware

CHRISTOPHER W. MACOSKO
University of Minnesota

(Continued from page 398)

ERRATA

The paper, "A Coordinate-Transformation Method for the Numerical Solution of Nonlinear Minimum-Time Control Problems," by Young D. Kwon and Lawrence B. Evans, *AIChE Journal* (**21** No. 6, 1158-1164, November, 1975) has errors in Figures 4 and 5. The label for each abscissa should read Chain Length instead of Molecular Weight. Also, the sentences immediately following Equations (48) and (49) should read $\gamma_k = 10^4$ instead of $\alpha = 10^4$.

In "A Model for Predicting Flow Regime Transitions in Horizontal and Near Horizontal Gas-Liquid Flow," *AIChE Journal*, **22**, 47 (1976) and in the Table of Contents of that issue the authors' names should read Yehuda Taitel and A. E. Dukler.