quite good, and most readers will find that the chapters serve as excellent review pieces.

These volumes will represent important sources of information for chemical engineers in research, process development, and process design. Coupled with the parent series that provides alphabetically arranged information, they represent an important resource that belongs in every technical library related in any way to the needs of chemical technologists and scientists. A subscription to the alphabetical series is not necessary in order to purchase these unit operations volumes. This reviewer recommends them highly!

James R. Fair
Dept. of Chemical Engineering
University of Texas
Austin, TX 78712

## Laboratory Studies of Heterogeneous Catalytic Processes

E. G. Christoffel (ed., Z. Paál), Elsevier Studies in Surface Science and Catalysis, Vol. 42, New York, 1989, 263 pp., $144.00.

This book is faithful to its name in presenting several aspects of the experimental study and analysis of heterogeneous catalytic reactions. The material is divided into four chapters: Introduction, Basic Phenomena and Concepts in Catalysis, Investigation of Heterogeneous Catalytic Reaction Systems, and Laboratory Reactors. The material is presented in very concise form and encompasses a wide range of technical levels. It thus serves primarily as a valuable, condensed reference work rather than a textbook in this reviewer's opinion.

The material of Chapter 3 on investigations of catalytic reactions is undoubtedly the strong point of the book. Contents start with means for investigation of reaction mechanisms, proceed to development of kinetic models with an excellent dicussion of parameter estimation methods, and conclude with discussions of mass transport and deactivation effects. A number of examples are included with the text material that serve as a valuable introduction to the original literature. The coverage of Chapter 4 on laboratory reactors is complimentary to that preceding, and applications of various typical reactors (flow, micropulse, etc.) are described in some detail. The contents of these two chapters can be highly recommended as supplementary to the contents of most current texts on catalysis or reaction engineering.

John B. Butt
Department of Chemical Engineering
Northwestern University
Evaston, IL 60201

## Handling of Bulk Solids, Theory and Practice

By P. A. Shamlou, Butterworths, Stoneham, MA, 1988, 193 pp., $49.95.

This book attempts to address the field of bulk solids handling on a more global basis than has been addressed previously. It is written in a style appropriate for advanced undergraduate or graduate courses on the topic, but also seems to have up to date references in most chapters so that the materials will be valuable to practitioner and researcher as well.

This book is broken down into eight chapters consisting of:

1. Bulk Solids Flow and Handling Properties
2. Pressure Profiles in Bulk Solids Storage Vessels
3. Design of Storage Vessels or Particulate Solids
4. Gravity Flow of Particulate Solids
5. Pneumatic Conveying of Bulk Solids
6. Hydraulic Transport of Particulate Solids
7. Mechanical Conveyors
8. Safety in Bulk Solids Handling

The first half of the book covers solids behavior in bins or vessels, with the interaction of the solids to the vessel and the vessel to the solids. This is a rather comprehensive treatment and should provide both the student and the designer with adequate information to handle this topic rather thoroughly. The references employed in the text are extensive and current, indicating the author's comprehension of the topic, and the historical references are not ignored.

The second half of the book addresses the pneumatic, hydraulic and mechanical transport, along with safety considerations. It is refreshing to see a chapter dedicated to safety to forward community awareness of safety issues for design considerations in the bulk handling of solids. The treatment of the transport sections is adequate, providing the reader with basic information on the topic and giving sufficient information to begin the design process. The detail present in the bin and vessel sections is somewhat lacking for the transport section, a lack which could stem from the author's interest and experience. Some current literature and small points are missing but these do not detract from the overall objective of the book, i.e., to provide information in one place about everything from storage to delivery of bulk solids.

The writing style is straightforward and clear in its approach. I believe that this book is a definite contribution to the field of bulk solids and handling. It is essential for the industrial and academic community to recognize the importance of this topic and that the behavior of solids is not like those of gases and liquids. This book goes a long way to meeting this challenge and should be considered for courses which cover bulk solids.

George E. Klinzing
School of Engineering
University of Pittsburgh
Pittsburgh, PA 15261

## Gas-Liquid-Solid Fluidization Engineering

By L. S. Fan, Butterworths series in Chemical Engineering, Stoneham, MA, 1989, 763 pp., $85.00.

This monograph presents a very detailed review of an important and timely subject. The author should be complimented for a rather complete presentation of the available literature on the hydrodynamics, mixing and transport characteristics of a variety of three-phase fluidized bed columns. The monograph should be useful to both industrial practictioners and students involved in re-