

AICHE JOURNAL

JUNE 1992 • VOL. 38, NO. 6

The AIChE JOURNAL, a monthly publication of the American Institute of Chemical Engineers, is devoted to fundamental research and developments having immediate or potential value in chemical engineering.

EDITOR

Matthew V. Tirrell

MANAGING EDITOR

Haeja L. Han

COPY EDITOR

Arthur H. Baulch

EDITORIAL ASSISTANT

Karen M. Simpson

CONSULTING EDITORS

Richard Alkire

Electrochemical Engineering

Robert A. Brown

Computation

Mark E. Davis

Catalysis

Morton M. Denn

Materials

George E. Keller, II

Separations

Michael T. Klein

Reaction Engineering

Douglas A. Lauffenburger

Bioengineering

Julio M. Ottino

Transport Processes

Ronald W. Rousseau

Crystallization

John Seinfeld

Environmental Engineering

Michael Shuler

Biochemical Engineering

George Stephanopoulos

Systems/Design

Larry F. Thompson

Electronic Materials

PRODUCTION DIRECTOR

Daniel Chillak

EDITOR-IN-CHIEF

Mark D. Rosenzweig

PUBLICATIONS DIRECTOR

Gary M. Rekstad

**NOW
AVAILABLE!**



**FREE
copy of
AIChE's
1992
Publications
Catalog**

With more than 300 titles to choose from, the AIChE Publications Catalog offers a wide selection of books, journals, periodicals, and software products at low member prices.

Best Source for Your Publication Needs

A 56-page offering of reference books, technical studies, reports, guidelines and procedures authored and edited by leading engineers, researchers, and practitioners.

Formatted for convenience

Organized, indexed, annotated and grouped into more than 30 chemical engineering disciplines.

For the latest research, case studies, applications and most significant findings in the CPL, send for your free copy of the AIChE 1992 Publications Catalog now.

Publication Sales Desk
American Institute of Chemical Engineers
345 East 47th Street
New York, NY 10017
Telephone: 212-705-7657
Fax: 212-752-3294.

AIChE Journal (ISSN 0001-1541) is published monthly by the American Institute of Chemical Engineers, 345 E. 47th St., New York, NY 10017. Manuscripts should be submitted to Editor Matthew V. Tirrell at the Dept. of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, MN 55455, phone (612) 625-5823, fax (612) 626-1686. The statements and opinions in the *AIChE Journal* are those of the contributors, and AIChE assumes no responsibility for them. Annual subscription rates: \$349 for nonmembers, \$60 for members, and \$30 for student members; outside U.S., add \$34 for postage. Single copies: \$35; outside U.S., add \$3 for postage. Second-class postage paid at New York, NY and additional mailing offices. Copyright 1992 by the American Institute of Chemical Engineers. Subscribers are requested to give prompt notification of any change of address. Postmaster: Send changes of address to *AIChE Journal*, 345 East 47th St., New York, NY 10017.

Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by AIChE for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the \$3.00 per copy fee is paid directly to CCC, 21 Congress St., Salem, MA 01970. This consent does not extend to copying for general distribution, for advertising or promotional purposes, for inclusion in a publication, or for resale. Articles published before 1988 are subject to the same copyright conditions and the fee for each article is \$2.00. *AIChE Journal* fee code: 0001-1541/92 \$3.00.