

AICHE JOURNAL

VOL. 49, NO. 1 JANUARY 2003

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.



www.aiche.org

Editor

Stanley I. Sandler

Publisher and Executive Editor

Haeja Lim Han

Associate Editors

Mark A. Barteau

Edward L. Cussler

Ignacio Grossmann

Julio M. Ottino

Sankaran Sundaresan

Copy Editor

Arthur H. Baulch

Editorial Assistants

Sally Mahon

Jed Hazlett

Cover Design

Fran Fresquez

Consulting Editors

Rakesh Agrawal

Separation Processes

Ilhan A. Aksay

Materials Processing

Juan Jose de Pablo

Computational Research

L. S. Fan

Particle Technology

Carol K. Hall

Thermodynamics

Eric W. Kaler

Colloidal Phenomena

George E. Keller, II

Separations

Sangtae Kim

Information Technology

Michael T. Klein

Reaction Engineering

Frederick J. Krambeck

Reactor Engineering

Anton Middelberg

Biomedical Engineering

Ronald W. Rousseau

Crystallization

John H. Seinfeld

Environmental Engineering

Michael L. Shuler

Biochemical Engineering

Group Publisher

Stephen R. Smith

AIChE Journal (ISSN 0001-1541)

is published monthly by the American Institute of Chemical Engineers, Three Park Avenue, New York, NY 10016-5991.

Manuscripts should be submitted to the *AIChE Journal* Editorial Office, Dept. of Chemical Engineering, University of Delaware, Newark, DE 19716-3110. Tel 302.831.6858, Fax 302.831.3226. E-mail: aichej@che.udel.edu

The statements and opinions in the *AIChE Journal* are those of the contributors, and AIChE assumes no responsibility for them.

Annual subscription rates are as follows.

Print version only:

N. American members, \$115

International members, \$215

N. American nonmembers, \$1,040

International nonmembers, \$1,140

Online version only:

Members, \$165

Nonmembers, \$1,100

Print plus Online:

N. American members, \$185

International members, \$285

N. American nonmembers, \$1,250

International nonmembers, \$1,350

For subscription, e-mail: xpress@aiiche.org or phone: 1-800-242-4363 (Toll Free) or 1-212-591-8100

Postage for domestic and international mailing paid at New York City and additional mailing offices.

Copyright © 2003 by the American Institute of Chemical Engineers.

POSTMASTER: Send change of addresses to *AIChE Journal*, Three Park Avenue, New York, NY 10016-5991.

Authorization to photocopy for internal or personal use is granted by AIChE for libraries and other users registered with the Copyright Clearance Center (CCC), provided that a fee of \$25.00 per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923. For its digital access, contact CCC by visiting rightslink.copyright.com/. This consent does not extend to copying for general distribution, inclusion in a publication, or resale, promotion and advertising.