## AIChE JOURNAL

**VOL.47, NO.10 OCTOBER 2001** 

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** Haeia Lim Han

Associate Editors Mark A. Barteau Edward L. Cussler Ignacio Grossmann Julio M. Ottino William Russel

Copy Editor Arthur H. Baulch

Editorial Assistant Jeff Karpinos

Cover Design Fran Fresquez

**Consulting Editors**Rakesh Agrawal
Separation Processes

Ilhan A. Aksay Materials Processing

Juan de Pablo Computational Research

L. S. Fan *Particle Technology* 

Alice P. Gast Materials

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

Ronald W. Rousseau Crystallization

John Seinfeld Environmental Engineering

Michael 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, \$100
International members, \$190
N. American student members, \$65
International student members, \$155
N. American nonmembers, \$895
International nonmembers, \$985

Online version only: Members, \$140 Student members, \$100 Nonmembers, \$980

Print plus Online:
N. American members, \$160
International members, \$250
N. American student members, \$125
International student members, \$215
N. American nonmembers, \$1,215
International nonmembers, \$1,305

For subscription, e-mail: xpress@aiche.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 © 2001 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 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 a fee of \$19.00 per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923.

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. *AIChE Journal* fee code: 0001-1541/00 \$19.00 per article.