

INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH

Editor:

DONALD R. PAUL,
University of Texas at Austin

Senior Editor:

Jerome A. Seiner,
PPG Industries

Associate Editors:

John L. Anderson,
Carnegie-Mellon University
J. D. Seader,
University of Utah

Manuscript Office:

Yvonne D. Curry,
Manager
Diane Scott,
Associate Editor
Marie C. Wiggins,
Associate Editor
Bryan D. Tweedy,
Editorial Assistant

Advisory Board

D. R. Bauer
Gary E. Blau
James R. Fair
Aage Fredenslund
Carlos E. Garcia
Cornelius F. Ivory
Klavs F. Jensen
Frederick J. Karol
Norman N. Li
Charles L. Liotta
William H. Manogue
Thomas J. McAvoy
Robert C. Reid
J. F. Roth
D. M. Ruthven
Wallace W. Schulz
Peter R. Sperry
William J. Ward, III
Ralph T. Yang

Industrial & Engineering Chemistry Research (ISSN: 0888-5885) is published monthly by the American Chemical Society at 1155 16th St., N.W., Washington, DC 20036. Second-class postage paid at Washington, DC, and additional mailing offices. POSTMASTER: Send address changes to *Industrial & Engineering Chemistry Research*, Member & Subscriber Services, P.O. Box 3337, Columbus, OH 43210.

PUBLICATIONS DIVISION

Robert H. Marks, Director

Journals Department: Charles R. Bertsch, Head; Marianne C. Brogan, Associate Head; Mary E. Scanlan and Joseph E. Yurvati, Journals Editing Managers; Jean M. Redmond, Assistant Editor

Advertising Office: Centcom, Ltd., 500 Post Road East, Westport, CT 06880

© Copyright 1991 by the American Chemical Society. **Copyright permission:** An individual may make a single reprographic copy of an article in this publication for personal use. Reprographic copying beyond that permitted by Section 107 or 108 of the U.S. Copyright Law is allowed, provided that the appropriate per-copy fee is paid through the Copyright Clearance Center, Inc., 27 Congress St., Salem, MA 01970. For reprint permission, please write to the Copyright Administrator, Publications Division, at the ACS Washington address.

The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences—Permanence of Paper for Printed Library Materials, ANSI Z39.48-1984.

Editorial Information

GUIDE FOR AUTHORS, published in the first issue of the year, gives copy requirements for manuscripts. A copyright status form is also published in the first issue.

Manuscripts for publication should be submitted in quadruplicate to Manager, Manuscript Office, at the ACS Washington address [(202) 872-4542; FAX (202) 872-6325]. Include a signed copyright status form.

Correspondence regarding **accepted papers and proofs** should be directed to the Journals Department at the address indicated.

Bulk reprints of individual articles are available. For information write to Distribution Office at the ACS Washington address.

The American Chemical Society and its Editors assume no responsibility for the statements and opinions advanced by contributors. Views expressed in the editorials are those of the authors and do not necessarily represent the official position of the Society.

Registered names and trademarks, etc., used in this publication, even without specific indication thereof, are not to be considered unprotected by law.

Subscription and Business Information

1991 subscription prices, including postage. (For membership information, contact Office of Membership Development at the ACS Washington address.)

		Canada and Mexico	Europe*	All Other Countries*
Printed				
Members—1 yr	\$ 58	\$ 76	\$ 96	\$104
2 yr	\$104	\$140	\$180	\$196
Nonmembers	\$413	\$431	\$451	\$459
Microfiche				
Members—1 yr	\$ 58	\$ 58	\$ 68	\$ 68
2 yr	\$104	\$104	\$124	\$124
Nonmembers	\$413	\$413	\$423	\$423
Supplementary material (microfiche)	\$ 15	\$ 21	\$ 21	\$ 21

* Air service included.

Rates quoted do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Company Ltd., 3-10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211.

New and renewal subscriptions should be sent with payment to American Chemical Society, Department L-0011, Columbus, OH 43268-0011. Subscriptions are available only on a calendar year basis.

Printed edition single issue price: current year, \$35.00; prior year, \$42.00. **Back volume price:** \$495.00. Foreign postage additional. Mail orders should be sent to Microforms & Back Issues Office at the ACS Washington address.

Phone orders can be placed for printed, microfiche, and microfilm editions by calling the ACS toll free at (800) 333-9511 from anywhere in the continental United States; elsewhere call (614) 447-3776. Phone orders can be charged to Visa, MasterCard, or American Express accounts.

Changes of address must include both old and new addresses with ZIP code and a recent mailing label. Send all address changes to Member & Subscriber Services. Please allow 6 weeks for change to become effective. **Claims for missing numbers** will not be allowed if loss was due to failure of notice of change of address to be received in the time specified; if claim is dated (a) North American: more than 90 days beyond issue date, (b) all other foreign: more than 180 days beyond issue date. Hard copy claims are handled by Member & Subscriber Services.

Supplementary material is noted in the table of contents with a ■. It is available as photocopy (\$10.00 for up to 3 pages and \$1.50 per page for additional pages, plus \$2.00 for foreign postage) or as 24× microfiche (\$10.00, plus \$1.00 for foreign postage). See supplementary material notice at end of journal article for number of pages. Orders *must* state whether for photocopy or microfiche and give complete title of article, names of authors, journal, issue date, and page numbers. Prepayment is required and prices are subject to change. Order from Microforms & Back Issues Office at the ACS Washington address. Supplementary material except structure factors also appears in the microfilm edition and may be ordered by subscription (in microfiche only).

American Chemical Society
1155 16th St., N.W.
Washington, DC 20036
(202) 872-4600
TDD (202) 872-8733
FAX (202) 872-4615

Journals Department
American Chemical Society
2540 Olentangy River Road
P.O. Box 3330
Columbus, OH 43210
(614) 447-3600, Ext. 3171
TELEX 6842086
FAX (614) 447-3745

Member & Subscriber Services
American Chemical Society
P.O. Box 3337
Columbus, OH 43210
(614) 447-3776
(800) 333-9511