

# ENERGY & FUELS

## EDITOR

JOHN W. LARSEN

Department of Chemistry  
Lehigh University  
Bethlehem, Pennsylvania 18015

## ADVISORY BOARD

M. M. Boduszynski  
Frank Burke  
Alan K. Burnham  
Dennis Finseth  
Peter Griffiths  
Patrick Hatcher  
Jack Howard  
Leszek Ignasiak  
Michael Lewan  
Paul Painter  
Marvin Poutsma  
Ronald Pugmire  
Y. Sanada  
Charles N. Satterfield  
Mike Siskin  
Leon Stock  
Eric Suuberg  
Curt White

*Energy & Fuels* (ISSN 0887-0624) is published bimonthly 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 *Energy & Fuels*, Member & Subscriber Services, P.O. Box 3337, Columbus, OH 43210.

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

## 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; Ramaswami Ravi, 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

**Instructions for authors** and copyright status form are printed in the first issue of each volume. Please conform to these instructions when submitting manuscripts.

**Manuscripts for publication** should be submitted to the Editor, John W. Larsen.

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.

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. Subscriptions are available only on a calendar year basis. (For membership information, contact Office of Membership Development at the ACS Washington address.)

	U.S.	Canada and Mexico	Europe*	All Other Countries*
<b>Printed</b>				
Members—1 yr	\$ 48	\$ 55	\$ 61	\$ 63
2 yr	\$ 86	\$100	\$112	\$116
Nonmembers	\$294	\$301	\$307	\$309
<b>Microfiche</b>				
Members—1 yr	\$ 48	\$ 48	\$ 53	\$ 53
2 yr	\$ 86	\$ 86	\$ 96	\$ 96
Nonmembers	\$294	\$294	\$299	\$299

\* Air service included.

**New and renewal subscriptions** should be sent with payment to American Chemical Society, Department L-0011, Columbus, OH 43268-0011. 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.

**Printed edition single issue prices:** current year, \$50.00; prior year, \$66.00. **Back volume price:** \$391.00. 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 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 a 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 for 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 also appears in the microfilm edition.