# Journal of Testing and Evaluation

## **Editorial Objectives**

The **Journal of Testing and Evaluation** is published bimonthly by ASTM, a nonprofit technical organization that develops and publishes voluntary consensus standards and related information for materials, products, systems, and services. All contributions are peer reviewed prior to publication.

The editorial objectives of this journal are to serve a broad-based audience by:

- 1. Publishing new technical information derived from the field and laboratory testing, performance, quantitative characterization, and evaluation of these materials, products, systems, and services.
- 2. Presenting new methods and data and critical evaluations of these methods and data.
- 3. Reporting the users' experience with test methods and the results of interlaboratory testing and analysis.
- Providing the scientific basis for both new and improved ASTM standards.
- 5. Stimulating new ideas in the fields of testing and evaluation.

## **Technical Editor**

#### Alan Wolfenden

Mechanical Engineering Department Texas A&M University College Station, TX 77843

## Editorial Board

George V. Aseff, Sr. Law Engineering Testing Company 396 Plasters Ave., N.E. Atlanta, GA 30324

Ray Bartnikas Institut de Recherche d'Hydro-Quebec 1800 Descente, Ste-Julie, Varennes, Quebec, Canada JOL 2PO

Gary Burnell GEC Turbine Generators Ltd. Rugby, CV21 2NH Warwičkshire, England

Anthony T. DiBenedetto Institute of Materials Science University of Connecticut Box U-136, Room 100 97 North Eagleville Rd. Storrs, CT 06268

Connie Glover Lancy Environmental Services Company P.O. Box 419 Pittsburgh, PA 15230

Harvey P. Hack Marine Corrosion Branch David Taylor Research Center Code 2813 Annapolis, MD 21402

Gerald M. Hodgson Moore Business Forms Research Center 300 Lang Blvd. Grand Island, NY 14072

Lyle R. Jenkins Ductile Iron Society 4525 Williamsburg Dr. Decatur, IL 62521

Adam Jostsons Australian Nuclear Science and Technology Organization (ANSTO) Locked Mail Bag No. 1 Manai, NSW 2234 Australia

Arthur H. Landrock PLASTEC, U.S. Army ARDEC Bldg. 355N Picatinny Arsenal, NJ 07806

**Theordore J. Louzon** AT&T Bell Laboratories Whippany Rd. Whippany, NJ 07981 Robert Megargle

Department of Chemistry Cleveland State University Euclid Ave. at East 24th St. Cleveland, OH 44115

Dr. Raymond D. Pavlovich Exxon Chemical Americas Polybilt 13501 Katy Freeway Houston, TX 77079

Donald R. Petersen Omni Tech International P.O. Box 2237 Midland, MI 48641

Samuel J. Schneider Institute for Materials Science and Engineering National Bureau of Standards Gaithersburg, MD 20899

**Robert S. Shane** Shane Associates, Inc. 238 Hemlock Rd. Wynnewood, PA 19096

**Richard L. Sheehan, Jr.** 3M Co. Packaging Systems Division

3M Center 230-1E-03 St. Paul, MN 55144

Everett C. Shuman 307 S. Corl St. State College, PA 16801

**Colleen M. Stuart** Technicorp 646 Eyster Blvd. Rockledge, FL 32959

**P. Aarne Vesilind** Department of Civil and Environmental Engineering Duke University Durham, NC 27706

Takao Wakamatsu Department of Architecture Faculty of Science and Technology Science University of Tokyo 2641 Yamazaki, Noda Chiba-Prefecture, 278 Japan

**Richard J. Wallace** Fluor Daniel Daniel Building DC07A)

Greenville, SC 29602 Ulf Wickström Statens Provningsanstalt

P.O. Box 857, S-501

15 Borås, Sweden

The American Society for Testing and Materials is not responsible, as a body, for the statements and opinions advanced in this publication.

Journal of Testing and Evaluation (ISSN 0090-3973) is publication. ASTM as part of the Testing and Evaluation Series, which includes the Geotechnical Testing Journal (published quarterly), Journal of Composites Technology & Research (published quarterly), and Cement, Concrete, and Aggregates (published semi-annually). Publication and editorial offices are located at ASTM Headquarters, 1916 Race St., Philadelphia, PA 19103.

1916 Race SL, Philadeepnia, PA 19103. **Subscriptions**. United States and Canada for 1 year \$60.00 (members \$45.00), for 2 years \$105.00 (members \$78.00), and for 3 years \$135.00 (members \$104.00). Foreign for 1 year \$68.00 (members \$51.00), for 2 years \$120.00 (members \$90.00), and for 3 years \$158.00 (members \$122.00). Single copies are \$14.00. To subscribe, please send prepaid order to ASTM, Subscription Dept.—JTE, 1916 Race St., Philadelphia, PA 19103. Journal of Testing and Evaluation is indexed regularly by Engineering Index, Inc., and is available on microfilm from University Microfilms, a Xerox Co., Ann Arbor, MI. Second class postage paid at Philadelphia, PA. Copyright 1990 by the American Society for Testing and Materials. **Permission to Copy.** The appearance of the code at the bottom of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use, or for the personal or internal use of specific clients. This consent is given on the condition, however, that the copier pay the stated per-copy fee through the Copyright Clearance Center, Inc., Operations Office, P.O. Box 765, Schenectady, NY 12301, for copying beyond that permitted by Sections 107 or 108 of the U.S. Copyright Law. (The per copy fee appears as the last four digits of the code at the bottom of the first page of each article). This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale. Further information may be obtained from the Copyright (212/697-2525).

Postmaster. Send Form 3579 to ASTM Headquarters, Subscription Dept., 1916 Race St., Philadelphia, PA 19103.

Change of Address. Please return entire addressing label on wrapper to ASTM, Subscription Dept.—JTE, 1916 Race St., Philadelphia, PA 19103 along with new address.

# **Editorial Staff**

Allan S. Kleinberg, Editor Bette Grugan, Secretary, Acquisition & Review Kathy Greene, Manager, Acquisition & Review Janet R. Schroeder, Director, Books and Periodical Publications

M. Bruce Vieth, Director, Production and Graphic Arts

## **ASTM Officers**

Albert J. Bartosic, *Chairman* Emery Farkas, *Vice-Chairman* John A. Millane, *Vice-Chairman* Nancy M. Trahey, *Treasurer* Joseph G. O'Grady, *President* 

#### Directors

Frederick B. Clarke Arthur Cohen Sheldon W. Dean, Jr. Edward F. Diekmann John E. Foster Connie Glover John J. Henry Ben M. Hillberry Thomas M. Hopkins Mary W. Jenkins A. Ivan Johnson Raymond G. Kammer Anthony G. Keane Harry E. Lunt George C. Moran Henry J. Roux John M. Scanlon, Jr. C. Ross Thomson Grover C. Williams

#### Past Chairmen

W. DeWayne France, Jr.

David M. Greason

### Committee on Publications

James S. Perrin, *Chairman* Leonard Mordfin, *Vice-Chairman* Albert J. Bartosic, *Ex officio* George Beestman Victor Chaker Gerald Davis Robert J. Goode

R. D. Hooton Larry P. Jackson W. Steven Johnson Paul H. Langer Howard J. Pincus John Rumble, Jr. Sherillyn K. Rutenbeck Kenneth R. St. John Kurt H. Strauss

# Information for Authors

The **Journal of Testing and Evaluation** publishes original articles of the following types:

#### Full-Length Papers (3000-5000 words)

- Reports of Original Investigations (research and field applications papers).
- Review Articles (state-of-the-art or literature reviews).
- Interlaboratory Research Reports (including data and statistical analysis).
- New Procedures (currently under development by a committee or authored by an individual).
- Case Studies (reports and analyses of noteworthy events or situations).

#### Shorter Technical Communications (500-1500 words)

- Technical Notes (brief papers on specific topics).
- Research Briefs (advance communications that will be followed by full-length papers).
- Conference Reports (extended abstracts).

#### Commentary (500-1000 words)

- Discussions of Previously Published Papers.
- Letters to the Editor.
- Invited Editorials.
- Reviews of Books and Standards.

The subject matter must not be of a speculative nature and the contents must not include materials of an advertising nature. The paper must not be seriously defective as to literary form and structure, continuity of thought, and clarity of expression. The substance of the paper should not have been published previously in the open literature.

Authors preparing papers for submittal should observe the conventions of style explained in the ASTM Style Manual. Since the journal does not request page charges, the author is expected to conform to these standard conventions for style. SI units are to be used throughout; if data were not measured in SI units, a note should appear to that effect and the original units should be included in parentheses after the SI units.

The original manuscript and four clear copies, including original illustrations, should be submitted to Kathy Greene, Manager, Acquisitions and Review, ASTM, 1916 Race St., Philadelphia, PA 19103.