World of Composites

EDITOR'S NOTE:

This issue of the World of Composites will feature a review of activities in ASTM's Subcommittee C28.07 on Ceramic Matrix Composites; announcements of three recent composite materials publications; a Technical Brief from the U.S. Army Research Lab; and an announcement of the Eighth Japan-U.S. Conference on Composite Materials will complete this issue.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

C28.07's Spring '97 Meeting Reviewed

C28.07 Ceramic Matrix Composites Spring Meeting

Background

The emphasis of Subcommittee C28.07, Ceramic Matrix Composites, is primarily continuous fibre ceramic composites (CFCCs).

Meeting Summary

Subcommittee C28.07 held a working meeting on 16 June 1997 at the Marriott Hotel in St. Louis, Missouri as part of Committee C-28's (Advanced Ceramics) regular meetings. Formal task group meetings of the subcommittee were held on 16 June. The following is a summary of those proceedings.

C28.07.01 Tension Task Group

Michael G. Jenkins, University of Washington

The new standard C 1359, Test Method for Monotonic Tensile Strength Testing of Continuous Fibre-Reinforced Advanced Ceramics with Solid Rectangular Cross Section Specimens at Elevated Temperatures, is currently undergoing editing and typesetting, with galley proofs expected in summer 1997. Minor revisions based on affirmative with comment ballots will be submitted for the committee-wide ballot in the near future. A draft standard on through-thickness tensile strength prepared was not ready for presentation at the meeting. Finally, an update on a round-robin in accordance with C 1275, the room temperature tensile test standard, was provided. A material system, supplier, and tensile specimen geometry have been chosen. The material has been ordered. These round robin tests will provide information for determining the precision and bias of the standard.

C28.07.02 Compression Task Group

Michael G. Jenkins, University of Washington

The new standard C 1359, Test Method for Monotonic Compressive Strength Testing of Continuous Fibre-Reinforced Advanced Ceramics with Solid Rectangular Cross Section Specimens at Ambient Temperatures, is currently undergoing editing and typesetting, with galley proofs expected in summer 1997. Minor revisions based on affirmative with comment ballots will be submitted for the committee-wide ballot in the near future.

C28.07.03 Creep/Creep Rupture Task Group

Edgar Lara-Curzio, Oak Ridge National Laboratory

No near-term changes were proposed for the recently approved standard C 1337, Test Method for Creep and Creep Rupture Testing of Continuous Fibre-Reinforced Advanced Ceramics. No interest has been expressed in conducting round robin tests for precision and bias of this standard, particularly because of the difficulty of coordinating long-term, high-temperature tests.

C28.07.04 Flexural Properties Task Group

Stephen Gonczy, Gateway Materials Technology

Several minor editorial changes were made to C 1341, Test Method for Flexural Properties of Continuous Fibre Ceramic Composites. Round robin tests will also be conducted for determining precision and bias of C 1341 in conjunction with those of the tension test task group. A flexure specimen geometry and the test fixture geometry have been chosen.

C28.07.05 Shear Properties Task Group

Edgar Lara-Curzio, Oak Ridge National Laboratory

A draft of a high-temperature version of C 1292, Test Method for Shear Strength of Continuous Fibre Ceramic Matrix Composites at

Ambient Temperatures, was not ready for presentation at the meeting. In addition, a draft of a standard test method for ceramic joints, based on an asymmetric four-point flexure test was not ready for presentation at the meeting. Round robin tests will also be conducted for determining precision and bias of C 1292 in conjunction with those of the tension test task group. Two shear test specimen geometries (Iosipescu double V-notch for in-plane and double notch for interlaminar) and the test fixture geometries have been chosen.

C28.07.06 Tension-Tension Cyclic Task Group

Michael G. Jenkins, University of Washington

The new standard C 1360, Practice for Constant-Amplitude, Axial, Tension-Tension Cyclic Fatigue of Continuous Fiber-Reinforced Advanced Ceramics at Ambient Temperatures, is currently undergoing editing and typesetting, with galley proofs expected in summer 1997. Minor revisions based on affirmative with comment ballots will be submitted for the committee-wide ballot in the near future.

C28.07.07 Ceramic Fiber Task Group

John Porter, Rockwell International Science Center

A new draft standard, Test Method for Tensile Strength and Young's Modulus for Ceramic Fibers, has undergone significant changes since its first ballot. J. Porter (Rockwell International), W. Hong (Institute for Defense Analyses), and J. Hurst (NASA-Lewis) led a well-attended, extended task group meeting (that is, workshop) on fibre testing on 12 January. Many of the issues discussed at this meeting are being used to complete the next draft standard. A new round robin on high-temperature fibre testing is planned. It was announced that Committee D-30 on Advanced Composites had officially transferred jurisdiction of D 3379, Test Method for Tensile Strength and Young's Modulus for High-Modulus Single Filament Materials, to Committee C-28 in April 1997. W. Hong, new task group leader pro temp, plans a series of immediate revisions to D 3379 for a subcommittee ballot in the near future as part of a mandatory reapproval ballot of this standard. These revisions will help modernize the standard as well as reflect recent findings applicable to testing fibres while work proceeds on developing the new ceramic fibre test method.

C28.07.08 Interfacial Properties Task Group

Edgar Lara-Curzio, Oak Ridge National Laboratory

A draft of an ASTM guide for interfacial property measurement is still under development.

C28.07.09 Thermal Properties Task Group

Stephen Gonczy, Gateway Materials Technology

A draft of an ASTM guide on appropriate test standards for thermal properties was not ready for presentation at the meeting.

Liaisons

Michael G. Jenkins, University of Washington

ASTM Committee D-30 on Advanced Composites has passed jurisdiction of the fibre testing standard, D 3379, to Committee C-28.

ASTM Committee E-80 on Fatigue and Fracture is interested in joint symposia although there is only passing interest in C28.07 activities.

The formal liaison with CEN TC184/SC1 on Ceramic Composites continues strongly. AFNOR, the secretariat for CEN TC184/SC1 continues a copious flow of documents to M. Jenkins. S. Gonczy expressed interest in reviewing a recently transmitted document on crack propagation in CFCCs.

Mil-Hdbk-17 developments included the formalization of the organization of the CMC working groups. One of these working groups, Testing, is co-chaired by M. Jenkins and E. Lara Curzio.

The subtask group on Ceramic Pressure Equipment of the task group on Graphite and Ceramic Pressure Equipment of the ASME Boiler and Pressure Vessel Code also has an effort on testing for a proposed new section on CFCCs in the Code.

ISO TC206 on Activities

Michael G. Jenkins, University of Washington

ISO TC206 on Fine Ceramics has recently approved a new working group (WG9) on tensile behavior of CFCCs with M. Jenkins as working group leader through ASTM and ANSI. This activity represents the first such effort to "internationalize" test methods for CFCCs. The plan is to quickly elevate the current draft standard to committee draft and then to draft an international standard within the next year. The first meeting of WG9 is scheduled for 3 July 1997 in Qingtao, P.R. China as part of the annual meeting of TC206.

Symposia

Michael G. Jenkins, University of Washington

Planning for a new symposium, "Environmental, Mechanical and Thermal Properties and Performance of Continuous Fibre Ceramic Composite Materials and Components," has begun. This symposium has received Committee C-28 executive committee approval and will be held in conjunction with the May 1999 meetings of both E-8 on Fatigue and Fracture and D-30 on Advanced Composites.

The next subcommittee meeting is scheduled for January 1998 in Cocoa Beach, Florida.

RECENT COMPOSITES PUBLICATIONS

Three Recent Publications on Composites Noted

Practical Analysis of Composite Laminates

REFERENCE: Reddy, J. N. and Miravete, A., *Practical Analysis of Composite Laminates*, CRC Press, Inc., Boca Raton, FL, 1995, 336 pp., ISBN: 0-8493-9401-5, $69.95.

Composite materials are increasingly used in aerospace, underwater, and automotive structures. They provide unique advantages over their metallic counterparts but also create complex challenges to analysts and designers.

Practical Analysis of Composite Laminates presents a summary of the equations governing composite laminates and provides practical methods for analyzing most common types of composite structural elements. Experimental results for several types of structures are included while theoretical and experimental correlations are discussed. The last chapter is devoted to practical analysis using designing advanced composites (DAC), a PC-based software on the subject. This text can be used for a graduate course in mechanical engineering as well as a valuable reference for professionals in the field.

Features

- Presents equations governing composite laminates
- Provides practical methods for analyzing structural elements
- Suggests a software program helpful in practical analysis

Contents

Mechanics of Laminated Composite Plates: Theory and Analysis

REFERENCE: Reddy, J. N., *Mechanics of Laminated Composite Plates: Theory and Analysis*, CRC Press, Inc., Boca Raton, FL, 1997, 800 pp., Catalog No. 3101, ISBN: 0-8493-3101-3, $95.00.

Composite materials are used in all kinds of engineering structures, medical prosthetic devices, electronic circuit boards, and sports equipment. The subject of these materials is an interdisciplinary area where chemists, material scientists, and chemical, mechanical, and structural engineers contribute to the overall product. This book presents detailed coverage of traditional theories and higher-order theories of laminated composite materials. Much of the text is based on the author's original work on refined theories of laminated composite plates and shells, and analytical and finite element solutions. In addition, the book reviews the basics including mathematical preliminaries, virtual work principles, and variational methods. *Mechanics of Laminated Composite Plates: Theory and Analysis* is a textbook for graduate-level courses on theory and/or analysis of composite laminates and can be conveniently divided into two sections: Chapters 1–8 for an introductory course and 9–13 for the advanced course.

Features

- Detailed coverage of laminate theories and analytical solutions—the first book of its kind
- Contains finite element solutions to illustrate concepts
- Based on author's well-known work on theories of laminated composite plates and shells
- Includes a review of the basics that serves as an introductory course in the mechanics of composite materials
- Incorporates exercises in most chapters to test your understanding of the material
- Illustrated with 245 figures, making concepts easy to visualize
- Provides summaries of data with more than 115 tables

Contents

Analytical Solutions of Rectangular Laminates Using FSDT

Introduction
Simply Supported Antisymmetric Cross-Ply Laminates
Simply Supported Antisymmetric Angle-Ply Laminates
Antisymmetric Cross-Ply Laminates with Two Opposite Edges Simply Supported
Antisymmetric Angle-Ply Laminates with Two Opposite Edges Simply Supported
Transient Solutions
Summary

Finite Element Analysis of Composite Laminates

Introduction
Laminated Beams and Plate Strips by CLPT
Timoshenko Beam/Plate Theory
Numerical Results for Beams and Plate Strips
Finite Element Models of Laminated Plates (CLPT)
Finite Element Models of Laminated Plates (FSDT)
Summary

Refined Theories of Laminated Composite Plates

Introduction
A Third-Order Plate Theory
Higher-Order Laminate Stiffness Characteristics
Navier Solutions
Lévy Solutions of Cross-Ply Laminates
Displacement Finite Element Model

Layerwise Theories and Variable Kinematic Models

Introduction
Development of the Theory
Finite Element Model
Variable Kinematic Formulations

Nonlinear Analysis of Composite Laminates

Introduction
Nonlinear Stiffness Coefficients
Solution Methods for Nonlinear Algebraic Equations
Computational Aspects and Numerical Examples
Closure

Designing with Reinforced Composites

REFERENCE: Rosato, D. V., *Designing with Reinforced Composites*, Hanser Gardner Publications, Cincinnati, OH, 1997, 401 pp., ISBN: 3-446-18254-3, hardcover, $148.00.

Widely used to design many products for over a century, composite materials have advanced rapidly in recent decades through major design developments and easier, more thorough processing techniques.

Designing with Reinforced Composites provides essential information to help manufacturers meet product performance requirements at the lowest cost, with zero defects.

This new book serves as a comparative guide to update technical and non-technical people about both common and advanced RPs based on past, present, and future trends. The importance of interrelating fabrication with designing composite products based on quality requirements is clearly explained. Expert reviews from leaders in the field are featured throughout the text to address useful technologies as they influence product design, that is, construction materials, processing, safety factors, prototyping, testing, quality control, statistical operations, and costing.

The emphasis of *Designing With Reinforced Composites* is on understanding the technology and business of designing and producing products. Many different examples are presented to address problems that may develop in different approaches, fabricating techniques, up to the final product. This data is needed for the decisions that must be made in developing a logical approach to design, especially when compromises are to be made.

TECHNICAL BRIEF

U.S. Army Research Lab Announces CIRTM

U.S. Army Research Laboratory/University of Delaware Technical Brief

Co-Injection Resin Transfer Molding (CIRTM)

The U.S. Army Research Laboratory and The University of Delaware Center for Composite Materials announce the joint development of a novel composite manufacturing technique that enables the injection of multiple resin systems into a single fiber layup and mold/vacuum bag. The Co-Injection Resin Transfer Molding (CIRTM) technique was developed to meet the need for affordable manufacturing of integral armor for Army applications. This composite consists of multiple layers that contribute various unique properties (fire resistance, strength, ballistic protection, and so forth) to the final composite. CIRTM offers the potential to satisfy multifunctional requirements, reduce costs, and increase quality, performance, and durability. The cost and time reduction aspects of CIRTM will become particularly apparent during the manufacture of composites employing multiple resin systems. Additionally, CIRTM eliminates the need for secondary bonding operations and reduces the potential for disbonds. A patent application has been submitted to the U.S. Patent and Trademark Office. A licensing meeting is scheduled for Thursday, 29 January 1998, at Aberdeen Proving Ground, MD. Contact Mike Rausa at 410-278-5028 or visit http://www.fedlabs.org/ma/pl for technical and registration information. A non-disclosure agreement **must** be signed before attending the licensing meeting.

CALL FOR PAPERS

Eighth Japan-U.S. Conference on Composite Materials

Eight Japan-U.S. Conference on Composite Materials

The Eighth Japan-U.S. Conference on Composite Materials will be held at the Sheraton Hotel, Inner Harbor in Baltimore, Maryland, on 24–25 Sept. 1998. The Conference will follow the 13th Annual Technical Conference of the American Society for Composites at the same location. The Conference is co-sponsored by the Japan Society for Composite Materials, the American Society for Composites, and Wayne State University. Papers are hereby solicited in all areas of composite materials, including the following topics:

- Composite Material Systems
- Synthesis of Composites
- Fabrication of Components
- Joining and Bonding
- Characterization
- Woven and N-Dimensional Materials Modeling
- High-Temperature Materials
- Interfaces and Interphases
- Composites for Space Applications
- Impact and Stress Waves Simulation
- Composite Structures
- Aeroelastic Tailoring
- Smart Structures
- Static and Dynamic Behavior Stress Analysis
- Property Characterization
- Performance
- Damage Analysis
- Mechanical Test Methods
- Nondestructive Test Methods
- Fatigue and Fracture Performance
- Thick Composite Sections
- Life Prediction

Selection of papers to be presented will be based on abstracts of 500 words or more including pertinent figures and references. Authors should emphasize new and significant findings rather than routine applications. Three copies of each abstract must be received by January 31, 1997 at one of the following addresses:

Golam M. Newaz,
Co-Chairman
Wayne State University
Mechanical Engineering Dept., Rm. 2135
Dept., Rm. 2140
5050 Anthony Wayne Dr.
Detroit, MI 48202
Ph: (313) 577-3877
Fax: (313) 577-8789
email: qnewaz@eng.wayne.edu

Ronald F. Gibson
Co-Chairman
Wayne State University
Mechanical Engineering
5050 Anthony Wayne Dr.
Detroit, MI 48202
Ph: (313) 577-3702
Fax: (313) 577-8789
email: gibson@eng.wayne.edu

The abstract must include the name, affiliation, telephone number, and mailing address of each author.

Authors will be notified of acceptance or rejection of their paper by March 1, 1998. Authors of accepted papers are required to provide a complete camera ready manuscript (mats and formats to be provided) by May 31, 1998. The papers will be published in a Proceedings of the Conference. The Organizing Committee will assume that authors have secured any necessary clearance for all abstracts and papers submitted.

Calendar on Composites

The following meetings may be of interest to researchers in the field of composite materials.

5–7 January 1998
The Second International Conference on Composites in Infrastructure (ICCI '98)
The University of Arizona
Contact: Engineering Professional Development, Box 9 Harvill Bldg., Room 235, The University of Arizona, P. O. Box 210076, Tucson, AZ 85721-0076; phone: 520-621-3054; fax: 520-621-1443; e-mail: baltes@engr.arizona.edu; http://engr.arizona.edu/~ICCI

19–21 January 1998
International Composites Expo '98-ICE '98
Nashville, Tennessee
Contact: International Composites Expo '98, Composites Institute, 355 Lexington Avenue, New York, NY 10017; fax-on-demand: 1-800-774-4614 ext. 8441

17–19 March 1998
7th International Conference on Marine Applications of Composite Materials (MACM '98).
Melbourne, Florida
Contact: MACM '98 Conference, 7705 Technology Drive, W. Melbourne, FL 32904-1576; phone: 407-951-9464; fax: 407-728-9071

3–5 May 1998
Nineteenth Southeastern Conference on Theoretical and Applied Mechanics and Student Paper Competition (SECTAM XIX)
Deerfield Beach, Florida
Contact: George Edmunds, Florida Atlantic University, Open University and Continuing Education, 777 Glades Road, Boca Raton, FL 33431; phone: 561-367-3258; fax: 561-367-3987; e-mail: edmunds@acc.fau.edu; http://www.fau.edu/divdept/engineer/sectam.htm

3–6 June 1998
ECCM—8 European Conference on Composite Materials.
Naples, Italy
Contact: Prof. A. Langella and Dr. C. Cigliano, ECCM-8, DIMP-University of Naples, Piazzale V. Tecchio, 80125 Naples, Italy; phone: +39 81 7682370/73; fax: +39 81 7614212; e-mail: crivisco@unina.it; http://www.eccm98.etruria.net

9–11 June 1998
Second International Conference on Composite Science and Technology (ICCST '98).
Durban, South Africa
Contact: Prof. S. Adali/Prof. E. Morozov/Prof. V. E. Verijenko, Conference Organizers, Department of Mechanical Engineering, University of Natal, Durban 4041, South Africa; phone: +27 31 260 3203; fax: 27 31 260 3217; e-mail: adali@eng.und.ac.za

14–19 June 1998
CIMTEC '98, 9th International Conference on Modern Materials and Technologies; Forum on New Materials, Topical Symposium V.
Florence, Italy
Contact: 9th CIMTEC, Forum on New Materials, Topical Symposium V, P.O. Box 165, 48018 Faenza, Italy; phone: +546-22461/+546-664143; fax: +546-664138/+546-663362

21–26 June 1998
Thirteenth U.S. National Congress of Applied Mechanics (USNCAM13).
Gainesville, Florida
Contact: USNCAM13, R. Mei, AeMES Department, University of Florida, P. O. Box 116250, Gainesville, FL 32611-6250; phone: 352-392-0961; fax 352-392-7303; e-mail: USNCAM13@aero.ufl.edu; http://www.aero.ufl.edu/usnc/usnatcon.html

6–8 July 1998
4th European Conference on Smart Structures and Materials; 2nd International Conference on Micromechanics, Intelligent Materials and Robotics (MIMR)
Harrogate, UK
Contact: Norma Parkes, Conference Secretariat, S.S.C., Department of Mechanical Engineering, The University of Sheffield, Mappin Street, Sheffield, S1 3JD, UK; phone: 44 114 222 7702; fax: 44 114 222 7890, e-mail: SSC@sheffield.ac.uk

5–7 August 1998
First International Conference on Durability of Composites for Construction (CDCC '98)
Sherbrooke (Quebec) Canada
Contact: Prof. Brahim Benmokrane, CDCC '98 Secretariat, Department of Civil Engineering, University of Sherbrooke, Sherbrooke, Quebec, Canada J1K 2R1; phone: 819-821-7758; fax: 819-821-7974; e-mail: bbenmokrane@andrew.sca.usherb.ca

22–24 September 1998
American Society for Composites, 13th Technical Conference on Composite Materials (before Japan-U.S. Meeting, see below)
Baltimore, Maryland
Contact: A. Vizzini, University of Maryland, Department of Aerospace Engineering, College Park, MD 20742; phone: 301-405-1123; fax: 301-314-9775; e-mail: vizzini@eng.umd.edu

24–25 September 1998
Eighth Japan-United States Conference on Composite Materials
Baltimore, Maryland
Contacts: Golam M. Newaz, Co-Chairman, Wayne State University, Mechanical Engineering Department, Room 2135, 5050 Anthony Wayne Dr., Detroit, MI 48202; phone: 313-577-3877; fax: 313-577-8789; e-mail: gnewaz@eng.wayne.edu; or Ronald F. Gibson, Co-Chairman, Wayne State University, Mechanical Engineering Department, Room 2140, 5050 Anthony Wayne Dr., Detroit, MI 48202; phone: 313-577-3702; fax: 313-577-8789; e-mail: gibson@eng.wayne.edu

27–30 September 1998
Society of Engineering Science, 35th Annual Technical Meeting (SES '98)
Pullman, Washington
Contacts: Prof. Hussein M. Zbib, School of Mechanical & Materials Engineering, Washington State University, Pullman, WA 99164-2920; phone: 509-335-7832/8654; fax: 509-335-4662; e-mail: ses98@mme.wsu.edu or Prof. Tom D. Burton, Department of Mechanical Engineering, Texas Technical University, Lubbock, TX 79409-1021; phone: 806-742-3563; fax: 806-742-3540; e-mail: metdb@coe3.coe.ttu.edu

Send items for this calendar to:
Prof. M. W. Hyer
Department of Engineering Science and Mechanics
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061-0219
Phone: 540-231-5372
Fax: 540-231-4574
e-mail: hyerm@vt.edu

Additional Information for Authors

The *Journal of Composites Technology & Research* (JCTR) is a quarterly publication sponsored by ASTM technical committee D-30 on High Modulus Fibers and Their Composites, and E-8 on Fatigue and Fracture. Each published paper and technical note has been peer-reviewed. Papers and technical notes are open to brief written comments in the Discussion section of the Journal, which also includes authors' written responses.

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The decision as to whether a manuscript is published as a paper or a technical note resides with the Technical Editor.

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The name, mailing address, position, affiliation, and telephone and fax number of each author must be supplied in a cover letter. The submitting author is to provide the names, affiliations, addresses, and telephone numbers of five to six individuals who are qualified to review impartially the paper and the research leading to it, and who are not employed at the same institution or company as any of the authors. While these names may or may not be used for the review, we will add them to our pool of potential reviewers. Also, a statement is to be included that the paper has not been published and is not under consideration for publication elsewhere. All permissions for previously published material used in the paper must be submitted in writing at this time.

The submitting author must also affirm that all those listed as co-authors have agreed (a) to be listed and (b) to submit the manuscript to ASTM for publication.

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The *revised* manuscript is to be sent on a $5\,^1/_4$ in. (133 mm) or $3\,^1/_2$ in. (89 mm) disk preferably in WordPerfect 5.1, with the corresponding hard copies. ASTM can convert from other word-processing packages as well.

*For complete manuscript instructions, which include a sample manuscript, call Shannon Wainwright, Administrative Assistant, ASTM Journals, 810/832-9618 or FAX 810/832-9623.

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Each figure is to be simple and uncluttered. All illustrations are to be placed together at the end of the manuscript with a separate sheet of figure captions. Consecutive Arabic (not Roman) numerals are required. The size of type in illustrations must be large enough to be legible after reduction. All lettering, lines, symbols, and other marks must be drawn in black India ink on white paper. Computer graphics must be produced by a laser printer. Photographs must be high-contrast black and white. SCALE MARKERS MUST BE SHOWN ON ALL PHOTOMICROGRAPHS AND ALL FIGURES THAT ARE REPRESENTATIONS OF EQUIPMENT OR SPECIMENS.

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References shall be cited in the text in numeric order. Type the numerical citation on the line, not as a superscript, and enclose in brackets. References should be listed together at the end of the paper in numeric order. They must contain enough information to allow a reader to consult the cited material with reasonable effort.

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Two or more reviewers, selected by a member of the Editorial Board, review each paper for technical content, originality, logical conclusions, sound data, reproducibility of results, and clarity of presentation; two or more reviewers provide reviews of each technical note. Their comments are compiled and evaluated. The reviewers' anonymous comments and any other comments from the Technical Editor or his designee are then returned to the author for revision.

The author must submit five copies of the revised manuscript with an annotated (highlighted) version of the paper indicating clearly where each revision has been made and identifying the reviewer's comment to which the revision is responding. Changes in the text including all MANDATORY reviewers' comments must be addressed explicitly on the "Authors' Response Form" provided during revision, as well as any explanation why a change was not made.

The Technical Editor will evaluate all revised manuscripts and make the final decision regarding publication in the Journal. The Editor may (1) accept the revised manuscript for publication, (2) require further revision or explanation, or (3) reject the revised manuscript. A revised manuscript may be sent for re-evaluation to a reviewer who has found major flaws in the original manuscript.

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Each accepted paper is edited by the ASTM staff for style, organization, and proper English usage. The edited manuscript is returned to the author before typesetting. The typeset page proof is also sent to the author and the Technical Editor for final review prior to printing.

If ASTM does not hear from the author by the time designated for return of the edited paper and/or page proof, ASTM will proceed with the publication process.

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ASTM receives books from other publishers requesting book reviews. The books are available to potential reviewers in exchange for publishable reviews. Book reviews are screened and edited by the Technical Editor and staff without peer review. Anyone interested in acting as a reviewer should contact Shannon Wainwright at ASTM. Phone: (610) 832-9618.

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Anyone having interesting test tips should submit a brief description of such innovations to the Testing Forum. Such contributions are screened and edited by the Technical Editor and staff without peer review.

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Complete Sections at Member Price	No Limit
Individual Book of Standards at Member Price	No Limit
Other Publications at Member Price	No Limit
Annual Subscription to **ASTM STANDARDIZATION NEWS**	1 Free
Advance Information about Standards & Activities	Yes

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