

MRS BULLETIN

March 1998

A Publication of the Materials Research Society

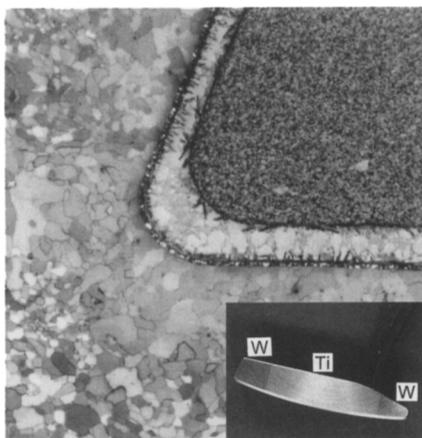
Volume 23, Number 3 ISSN: 0883-7694 CODEN: MRSBEA

MATERIALS FOR SPORTS

- 32 Materials for Sports**
F.H. Froes, Guest Editor
(with contributions by S. Haake,
S. Fagg, K. Tabeshfar, and X. Velay)
- 39 Material Matters:
Performance Standards
Governing New Materials
for Sports**
J.N. Gelberg
- 42 Titanium Golf Clubs**
C. Shira and F.H. Froes
- 47 Education Exchange:
Independent-Study Course
Examines Materials in
Tennis Rackets and
Hockey Sticks**
E.M. Lenoë
- 50 The Role of Materials in
the Design of an Improved
Cricket Bat**
C. Grant
- 54 Historical Note:
Bicycles Roll Along from
Wooden Wagon Wheel to
Alloy Tubing**
C.J. McMahon, Jr.
- 56 Modeling Bicycle-Rider
Vibrations: Implications for
Materials Selection**
T.T. Gribb, F.J. Worzala, and
G.W. Gribb

MRS NEWS

- 59 1997 Fall Meeting Reflects
Popularity and Breadth of
MRS Meetings**
- 76 Charles B. Duke Receives
1997 Woody Award**
- 76 MRS Invites Nominations for
the Von Hippel Award,
Turnbull Lectureship, and
MRS Medal**
- 78 Congressional Fellow Brian
Holloway Illuminates
Materials Issues in
Washington Policy**
- 79 Anne Mayes Named
Outstanding Young
Investigator for Work on
Macromolecules**
- 80 Plenary Speaker Lockwood
to Address Materials Aspect
of Volcanoes at MRS Spring
Meeting**



ON THE COVER: Titanium-tungsten braze joint in a putter.

Inset: Putter featuring a titanium center section and tungsten for the heel and toe. The moment of inertia is 4,330 g/cm², a substantial 65% increase over earlier putters made of 100% brass.

ABSTRACTS

- 87 Abstracts for May 1998**
Journal of Materials Research

DEPARTMENTS

- 6 Material Matters**
*What Are the Options for
Disposition of Excess Weapons
Plutonium?*
W. Stoll
- 18 Letters to the Editor**
- 19 Research/Researchers**
- 27 Washington News**
- 29 Public Affairs Forum**
- 30 Resources**
- 84 Library**
*Mössbauer Spectroscopy Applied
to Magnetism and Materials
Science, Vol. 2*, G.J. Long and
F. Grandjean, eds., reviewed by
G. Le Caër; *Current Opinion in Solid
State and Materials Science*,
A.K. Cheetham, M.S. Dresselhaus,
and J.M. Thomas, eds., reviewed
by P. Calvert; *Forward Recoil
Spectrometry: Applications
to Hydrogen Determination in
Solids*, J. Tirira, Y. Serruys, and
P. Trocellier, reviewed by K-P. Lieb
- 85 Advertisers in This Issue**
- 97 Calendar**
- 101 Classified**
- 104 Postterminaries**

About the Materials Research Society

The Materials Research Society (MRS), a not-for-profit scientific association founded in 1973, promotes interdisciplinary goal-oriented basic research on materials of technological importance. Membership in the Society includes over 12,000 scientists, engineers, and research managers from industrial, government, and university research laboratories in the United States and nearly 68 countries.

The Society's interdisciplinary approach differs from that of single-discipline professional societies because it promotes information exchange across the many technical fields touching materials development. MRS sponsors two major international annual meetings encompassing approximately 70 topical symposia, and also sponsors numerous single-topic scientific meetings. The Society recognizes professional and technical excellence and fosters technical interaction in local geographic regions through Sections and University Chapters.

MRS participates in the international arena of materials research through the International Union of Materials Research Societies (IUMRS). MRS is a member of the Federation of Materials Societies and is an affiliate of the American Institute of Physics.

MRS publishes symposium proceedings, *MRS Bulletin*, *Journal of Materials Research*, and other publications related to current research activities.

MRS Bulletin (ISSN: 0883-7694) is published 12 times a year by the Materials Research Society, 506 Keystone Drive, Warrendale, PA 15086-7573. Application to mail at periodicals rates has been approved at Warrendale, PA and at additional mailing offices. POSTMASTER: Send address changes to *MRS Bulletin* in care of the Materials Research Society, at the address listed; phone 724-779-3003; fax 724-779-8313. Printed in the U.S.A.

Additional copies of articles in *MRS Bulletin* may be made at \$2.50 per article. This fee can be paid to the Materials Research Society through the Copyright Clearance Center, Inc., 27 Congress Street, Salem, MA 01970.

Membership in MRS is \$75 annually for regular members, \$25 for students. Dues include an allocation of \$29 (\$17 for students) to a subscription to *MRS Bulletin*. Individual member subscriptions are for personal use only. Non-member subscription rates are \$155 for one calendar year (12 issues) within the U.S.A. and \$215 elsewhere. Single copies may be purchased for \$16 each. Send subscription orders to Subscription Department, Materials Research Society, 506 Keystone Drive, Warrendale, PA 15086-7573.

MRS Bulletin is included in *Current Contents®/Engineering, Computing, and Technology*; *Current Contents®/Physical, Chemical, and Earth Sciences*, the *SciSearch®* online database, *Research Alert®*, *Science Citation Index®*, and the *Materials Science Citation Index®*. Back volumes of *MRS Bulletin* are available in 16 mm microfilm, 35 mm microfilm, or 105 mm microfiche through University Microfilms Inc., 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Materials Research Society
506 Keystone Drive
Warrendale, PA 15086-7573 USA
Tel. 724-779-3003; Fax 724-779-8313
<http://www.mrs.org/>

MRS BULLETIN

Editorial Office • 506 Keystone Drive • Warrendale, PA 15086-7573 USA
Tel. 724-779-3004 ext. 522; fax 724-779-8313; <http://www.mrs.org/>

Editor
E.L. Fleischer

Managing Editor
J. Meiksin

Assistant Editor
L.R. Gallagher

Art Director
E. Stiller

Design/Production
T. Aiello and S. Franklin

Editorial Assistants
J. Dininny and
M. Wilmoth

Advertising
M.E. Kaufold

Circulation
S. Forrest

Guest Editor
F.H. Froes

Special Contributors
S. Beckerman, P. Calvert,
E.N. Kaufmann, G. Le Caër,
K-P. Lieb, J.M. Phillips, G. Rao,
L.A. Snyder, and W. Stoll

Special Consultant
M. Goodway

Associate Editor—Europe
I.W. Boyd, University College London
Dept. of Electronic and
Electrical Engineering
Torrington Place
London WC1E 7JE, U.K.
Tel. 44-171-380-7300 or 7302

Book Review Board
M.A. Nastasi (Chair), J.C. Bravman,
R.W. Cahn, M.L. Green, and
E.J. Kramer

MRS Office of Public Affairs
601 13th Street, NW, Suite 1000 South
Washington, DC 20005-3807
Tel. 202-661-2285, Fax 202-661-2299

EDITORIAL BOARD

M.A. Nastasi, Chair
Los Alamos National Laboratory
Los Alamos, NM

W.L. Brown
Bell Laboratories, Lucent Technologies
Murray Hill, NJ

R.W. Cahn (1997 Visiting Scientist)
Cambridge University
Cambridge, UK

D.J. Eaglesham
Bell Laboratories, Lucent Technologies
Murray Hill, NJ

E.J. Kramer
University of California—Santa Barbara
Santa Barbara, CA

G.G. Long
National Institute of Standards
and Technology
Gaithersburg, MD

S.C. Moss
Aerospace Corporation
Los Angeles, CA

W.D. Nix
Stanford University
Stanford, CA

S.J. Pearton
University of Florida
Gainesville, FL

S.T. Picraux
Sandia National Laboratories
Albuquerque, NM

Y. Shiohara
ISTEC
Tokyo, Japan

C.C. Tsai
Applied Komatsu Technology
Santa Clara, CA

VOLUME ORGANIZERS

1998

O. Auciello
Argonne National Laboratory
Argonne, IL

R.J. Composto
University of Pennsylvania
Philadelphia, PA

P.M. Fauchet
University of Rochester
Rochester, NY

1999

M.I. Baraton
University of Limoges
Limoges, France

R.C. Cammarata
Johns Hopkins University
Baltimore, MD

S.M. Yalisove
University of Michigan
Ann Arbor, MI

VISITING SCIENTISTS

V.S. Arunachalam (1998)
Carnegie Mellon University
Pittsburgh, PA

R.W. Cahn (1997)
Cambridge University
Cambridge, UK

F.W. Clinard (1996)
Los Alamos National Laboratory
Los Alamos, NM

R.L. Fleischer (1995)
Union College
Schenectady, NY

1998 MRS EXECUTIVE COMMITTEE

President
R.J. Nemanich
North Carolina State University

Treasurer
A. Hurd
Sandia National Laboratories

Councillors
H.A. Atwater
California Institute of Technology

Vice President and President-Elect
R. Gibala
University of Michigan

Immediate Past President
R. Hull
University of Virginia

M.L. Green
Bell Laboratories/Lucent
Technologies

Secretary
C.C. Tsai
Applied Komatsu Technology

**Executive Director
Materials Research Society**
John B. Ballance

INTERNATIONAL UNION OF MATERIALS RESEARCH SOCIETIES

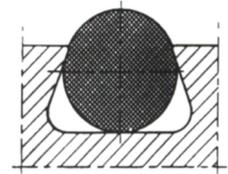
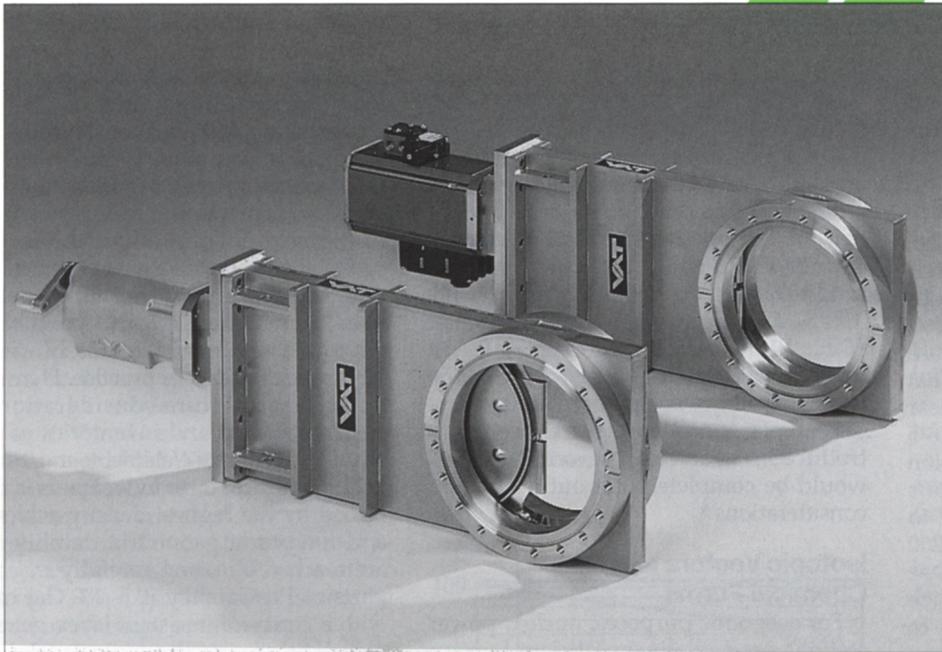
President	First Vice President	Second Vice President	Secretary	Treasurer	Immediate Past President	General Secretary
R.C. Ewing University of Michigan Ann Arbor, MI, USA	H-D. Li Tsinghua University Beijing, China	P.A. Glasow Erlangen, Germany	C-G. Li Beijing, China	R-I. Yamamoto University of Tokyo Tokyo, Japan	M. Doyama Nishi-Tokyo University Tokyo, Japan	R.P.H. Chang Northwestern University Evanston, Illinois, USA

IUMRS ADHERING BODIES

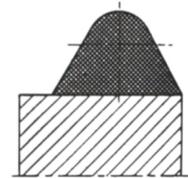
Australian Materials Research Society (A-MRS) J.S. Williams, Australian National University	Materials Research Society of India (MRS-I) S.K. Joshi, JNCASR, New Delhi	Materials Research Society of Russia (MRS-Russia) I.V. Gorynin, Prometey Institute
Chinese Materials Research Society (C-MRS) H-D. Li, Tsinghua University	Materials Research Society of Japan (MRS-J) R-I. Yamamoto, University of Tokyo	Materials Research Society of Taiwan (MRS-T) L.J. Chen, National Tsing Hua University
European Materials Research Society (E-MRS) G.M. Crean, University College	Materials Research Society of Korea (MRS-Korea) S-J. Park, Seoul National University	Mexican Materials Research Society (Mexican-MRS) L.M. Gomez, Instituto de Fisica-Cuernavaca, UNAM
Materials Research Society (MRS) R.J. Nemanich, North Carolina State University		



Innovation in
UHV Gate Valves
Series 10 with
"Vulcanized" Gate Seal



Conventional
O-Ring Gate
Seal



VAT Vulcanized
UHV Gate
Seal

- One Sealing Line Only
- No Trapped Volumes
- Higher Lifetime

Request your new Catalog 2000 today



VAT, Inc., 500 West Cummings Park, Woburn, MA 01801
781-935-1446 Fax 781-935-3940
e mail: usa@vatvalve.com <http://www.vatvalve.com>

Circle No. 30 on Reader Service Card.