

MRS

BULLETIN

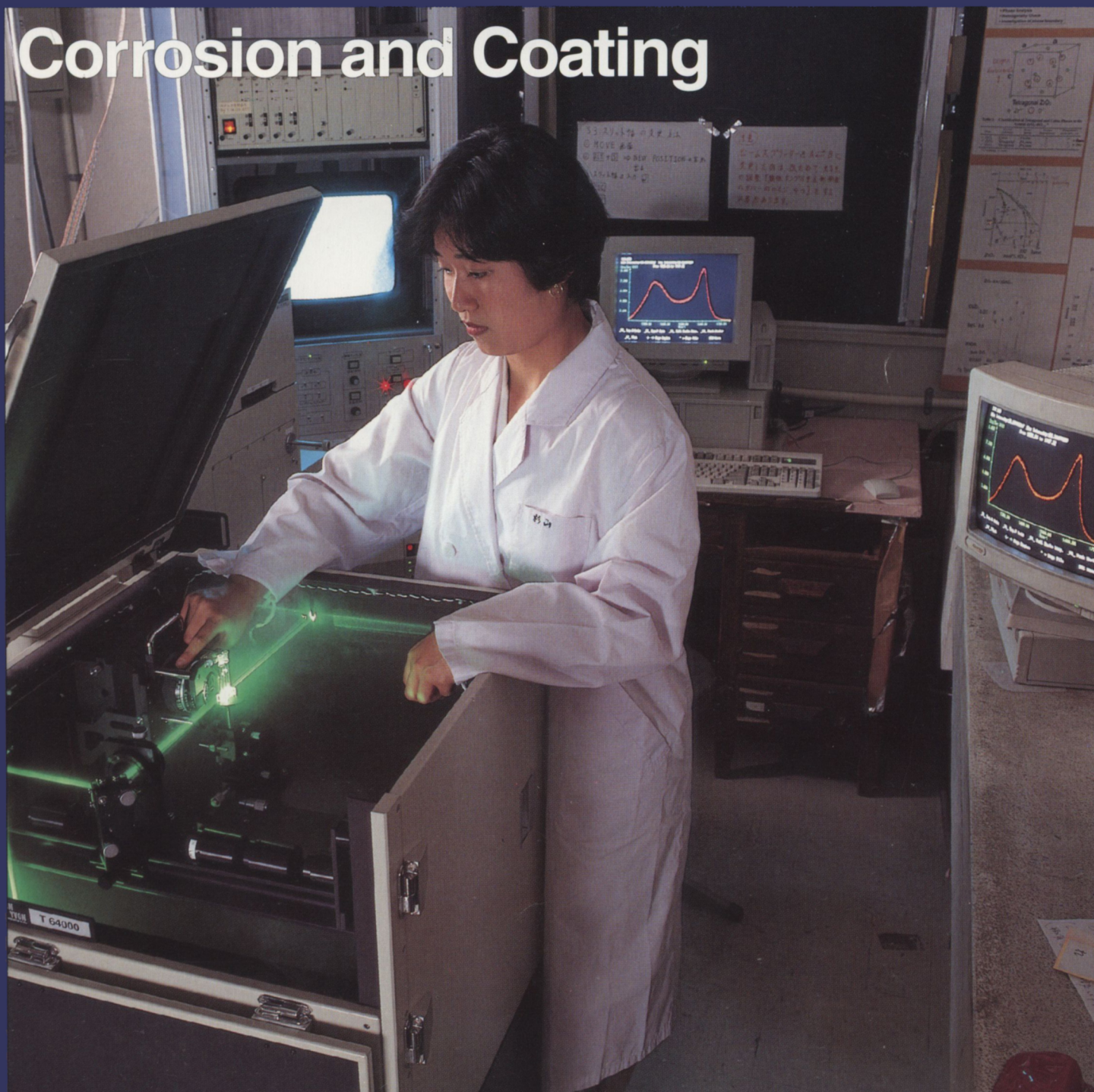
Serving the International
Materials Research Community

A Publication of the Materials Research Society

October 1994, Volume XIX, No. 10



Corrosion and Coating



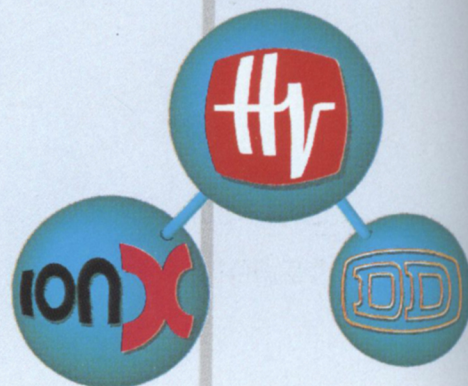
HAVE YOU HEARD THE RUMOUR??

...that High Voltage Engineering is currently developing a 3.5MV/TV -high current- tandem accelerator? Well... **they are not**, because HVEE has already finished the 3.5MV Tandetron and it performs extremely well!

In addition to higher terminal voltages, the HVEE Tandetron accelerators are now available with a novel, patented 90° dual ion source -high current- injector system and full computer control for unattended start-up and operation.

The new HVEE Tandetron accelerator systems can be installed in a single room laboratory without the need of a HV protection cage or additional X-ray shielding.

Circle no. 1 reader service card for product literature.



DIVISIONS
GENERAL IONEX
DOWLISH DEVELOPMENTS



More
Energy for Research

HIGH VOLTAGE ENGINEERING EUROPA B.V.

P.O. Box 99, 3800 AB Amerstort, The Netherlands. Phone: (+31) 33-619741, Fax: (+31) 33-615291.

For Japan: MARUBUN CORP., 8-1 Nihombashi Ddemmacho, Chuo-ku, Tokyo, 103 Japan. Phone 03-3639-9861, Fax 03-3639-

Visit MRS Exhibit
Booth No. U941

<https://doi.org/10.1051/97803030400048090> Published online by Cambridge University Press

MRS BULLETIN

October 1994

A Publication of the Materials Research Society

Volume XIX, Number 10 ISSN: 0883-7694 CODEN: MRSBEA

CORROSION AND COATING

- 20 Corrosion and Coating of Advanced Materials**
M. Yoshimura and F.H. Stott,
Guest Editors
- 23 High-Temperature Oxidation of Stainless Steels**
J.C. Colson and J.P. Larpin
- 26 Limitations on the Use of Surface Doping for Improving High-Temperature Oxidation Resistance**
B.A. Pint
- 31 Coatings for TiAl**
S. Taniguchi
- 35 Refractory Oxide Coatings on SiC Ceramics**
K.N. Lee, N.S. Jacobson,
and R.A. Miller
- 39 Water Effects on Corrosion Behavior of Structural Ceramics**
Y.G. Gogotsi and M. Yoshimura
- 46 Degradation of Thermal-Barrier Coatings at Very High Temperatures**
F.H. Stott, D.J. de Wet, and
R. Taylor

MRS NEWS

- 13 Treasurer's Report**
- 50 Preview: 1994 MRS Fall Meeting**

DEPARTMENTS

- 4 Letters to the Editor**
- 5 Research/Researchers**
- 15 From Washington**
- 16 Editor's Choice**
- 17 Resources**
- 63 Education Exchange**
- 65 Historical Note**
- 67 Upcoming Conferences**
- 67 Section News**
- 69 Library**
- 71 Classified**
- 72 Advertisers in This Issue**



ON THE COVER: Laser Raman microprobe system (Jobin-Yvon/Atago Bussan) used at the Tokyo Institute of Technology for analyzing corroded and coated surfaces of advanced materials. The technician is adjusting the optical system. Spectra of a 70-nm-thick carbon layer formed under hydrothermal conditions on SiC fibers are shown. For more information about this topic, see "Water Effects on Corrosion Behavior of Structural Ceramics" by Y. Gogotsi and M. Yoshimura on p. 39.

Editorial Office • 9800 McKnight Road • Pittsburgh, PA 15237-6006
Tel. (412) 367-3003; fax (412) 367-4373

The Materials Research Society (MRS), a non-profit scientific association founded in 1973, promotes interdisciplinary goal-oriented basic research on materials of technological importance. Membership in the Society includes nearly 11,600 scientists, engineers, and research managers from industrial, government, and university research laboratories in the United States and nearly 50 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 50 topical symposia, and also sponsors numerous single-topic scientific meetings. The Society recognizes professional and technical excellence, conducts short courses, 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 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, 9800 McKnight Road, Pittsburgh, PA 15237. Application to mail at second class rates has been approved at Pittsburgh, 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 (412) 367-3003; Fax (412) 367-4373. Printed in the U.S.A.

Additional copies of articles in the *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 and retired members. Dues include an allocation of \$25 (\$15 for students and retirees) to a subscription to *MRS Bulletin*. Individual member subscriptions are for personal use only. Non-member subscription rates are \$112 for one calendar year (12 issues) within the U.S.A. and \$165 elsewhere. Single copies may be purchased for \$16 each. Send subscription orders to Subscription Department, Materials Research Society, 9800 McKnight Road, Pittsburgh, PA 15237.

MRS Bulletin is included in Current Contents/*Physical, Chemical & Earth Sciences*[™], *Research Alert*, and the *Materials Science Citation Index*[™]. Back volumes of *MRS Bulletin* are available in 16mm microfilm, 35mm microfilm, or 105mm microfiche through University Microfilms Inc., 300 North Zeeb Road, Ann Arbor, Michigan 48106.

**Materials Research Society
9800 McKnight Road**

Pittsburgh, PA 15237-6006

Tel. (412) 367-3003; Fax (412) 367-4373

Publisher

G.A. Oare

Editor

E.L. Fleischer

Managing Editor

F.M. Wieloch

Copy Editors

J. Guenther, L.A. Krynski,
S.W. Morelli, D.M. Varner

Art Director

C. Love

Design/Production

T. Aiello, S. Franklin

Editorial Assistants

M.M. Costello, J. Dininny

Advertising

M.E. Kaufold

Circulation

S.E. Krassa

Guest Editors

M. Yoshimura and F.H. Stott

Special Contributors

K.J. Anderson, J.E. Boyd,
J. Ferrante, F.S. Myers

Special Consultant

M. Goodway

Associate Editor—Europe

I.W. Boyd
University College London
Dept. of Electronic and
Electrical Engineering
Torrington Place
London WC1 E7 JE, U.K.
Tel. 71-387-7050 ext. 3956 or 7304

Book Review Editor

C.J. McHargue
University of Tennessee
Knoxville, Tennessee

MRS Office of Public Affairs

555 13th Street NW, Suite 900 East
Washington, DC 20004
Tel. (202) 383-8809, Fax (202) 383-8877

CHAIRMAN—EDITORIAL BOARDS

E.N. Kaufmann • Argonne National Laboratory • Argonne, Illinois, USA

INTERNATIONAL ADVISORY BOARD

M. Balkanski
University of Pierre and Marie Curie
Paris, France

R.G. Elliman
Australian National University
Canberra, Australia

S. Hsu
Chung Shan Institute of Science
and Technology, Retired
Taiwan, China

L.C. Ianniello
U.S. Department of Energy, Retired
Washington, DC, USA

H-D. Li
National Science Foundation-China
Beijing, China

P. Rama Rao
Ministry of Science and
Technology
New Delhi, India

R. Roy
Pennsylvania State University
University Park, Pennsylvania, USA

T. Sugano
Toyo University
Tokyo, Japan

D.L. Weaire
University of Dublin
Dublin, Ireland

TECHNICAL EDITORIAL BOARD

J.C. Bravman
Stanford University
Stanford, California, USA

C.W. Draper
AT&T Engineering Research Center
Princeton, New Jersey, USA

E. Fogarassy
Centre de Recherches Nucléaires
Strasbourg, France

F.Y. Fradin
Argonne National Laboratory
Argonne, Illinois, USA

B.M. León
Universidad de Vigo
Vigo, Spain

G.L. Liedl
Purdue University
West Lafayette, Indiana, USA

S. Namba
Osaka University
Osaka, Japan

A.D. Romig Jr.
Sandia National Laboratories
Albuquerque, New Mexico, USA

J. Soares
Universidade de Lisboa
Lisboa, Portugal

K.C. Taylor
General Motors Research Laboratories
Warren, Michigan, USA

MRS BULLETIN PUBLICATIONS SUBCOMMITTEE

A.J. Hurd
Sandia National Laboratories
Albuquerque, New Mexico

M.R. Libera
Stevens Institute of Technology
Hoboken, New Jersey

J.M. Phillips
AT&T Bell Laboratories
Murray Hill, New Jersey

D.B. Paker
Oak Ridge National Laboratory
Oak Ridge, Tennessee

S.M. Prokes
Naval Research Laboratory
Washington, DC

C.W. White
Oak Ridge National Laboratory
Oak Ridge, Tennessee

1994 MRS EXECUTIVE COMMITTEE

President

John C. Bravman
Stanford University

First Vice President and President-Elect

Julia M. Phillips
AT&T Bell Laboratories

Second Vice President

Carl V. Thompson
Massachusetts Institute of Technology

Secretary

Carl C. Koch
North Carolina State University

Treasurer

A. Kay Hays
Sandia National Laboratories

Immediate Past President

S.T. Picraux
Sandia National Laboratories

**Executive Director
Materials Research Society**

John B. Ballance

INTERNATIONAL UNION OF MATERIALS RESEARCH SOCIETIES

President

Paul Siffert
Centre de Recherches Nucléaires,
France
Tel. (33) 88 10 65 43; Fax (33) 88 10 62 93

Vice President

Masao Doyama
Nishi-Tokyo University, Japan
Tel. (81) 3 3339 0519;
Fax (81) 3 3310 0931

Secretary

Rodney C. Ewing
University of New Mexico, USA
Tel. (505) 277-4163;
Fax (505) 277-0090

Treasurer

Li-Chung Lee
ITRI, Taiwan
Tel. (886) 35-820205;
Fax (886) 35-820247

Immediate Past President

Secretary General
R.P.H. Chang
Northwestern University, USA
Tel. (708) 491-3598; Fax (708) 491-4181

IUMRS ADHERING BODIES

Australian Materials Research Society (A-MRS)
J.S. Williams

Chinese Materials Research Society (C-MRS)
Hengde Li

European Materials Research Society (E-MRS)
P.A. Glasow

Materials Research Society (MRS)
John C. Bravman

Materials Research Society of India (MRS-I)
P. Rama Rao

Materials Research Society of Japan (MRS-J)
T. Masumoto

Materials Research Society of Korea (MRS-Korea)
Min Che Chon

Materials Research Society of Taiwan (MRS-T)
Li-Chung Lee

Mexican Materials Research Society (Mexican-MRS)
M.J. Yacamán

Hitachi's cold field emission TEM. Takes electron microscopy into a new era.

The advantages of a cold field emission (FE) electron source over thermionic sources are unquestioned — higher brightness and beam coherency, small size and reliable drift-free operation.

Now, with the HF-2000, we've incorporated this powerful source into our proven TEM technology. Raised analytical electron microscopy to a new level. And achieved it without compromising the stable, reliable performance that marks all our electron microscopes.

Begin with source brightness. In the HF-2000, it's 100 times that of LaB₆ emitters, 1000 times that of tungsten filaments. Similarly, there's

no comparison in electron energy spread. At 0.3 eV, it's a small fraction of that of other sources. Further, the HF-2000 has a high probe current — of the order of 1 nA — contained in a probe a mere 1 nm across. And the 10⁻¹⁰ Torr vacuum maintained by the system's ion and turbo-molecular pumps helps ensure emitter life exceeding 1000 hours.

Higher resolution, higher contrast imaging. True nano-area X-ray microanalysis. Easily applied electron holography. Dependable, drift-free operation. Answering these as well as other future needs, our cold field emission TEM is a system you'll want to learn more about. Call or

write for details or to arrange a demonstration of the HF-2000. It's a genuine breakthrough. **And another promise kept.**

HITACHI

SCIENTIFIC INSTRUMENTS
Nissei Sangyo America, Ltd.

755 Ravendale Drive
Mountain View, CA 94043
(415) 969-1100

25 West Watkins Mill Road
Gaithersburg, MD 20878
(301) 840-1650

