MRS BULLETIN

October 1999

A Publication of the Materials Research Society

Volume 24, Number 10 ISSN: 0883-7694 CODEN: MRSBEA

MATERIALS SCIENCE OF THE CELL

- 19 Materials Science of the Cell
 D. Wirtz and E. Evans,
 Guest Editors
- 22 Biomechanical Properties of Fibroblasts
 - O. Thoumine and A. Ott.
- 27 The Cell's Biological Rods and Ropes
 - D. Boal
- 32 Materials Engineering of Lipid Bilayers for Drug Carrier Performance
 - D. Needham

TECHNICAL FEATURES

42 Bulk Glass-Forming
Metallic Alloys: Science
and Technology
1998 MRS Fall Meeting
MRS Medal
W.L. Johnson

SPECIAL FEATURES

57 Bounded Rationality and Materials Selection

V.S. Arunachalam and R. Bhaskar

INTERNATIONAL UNION OF MATERIALS RESEARCH SOCIETIES

62 IUMRS-ICAM'99 Presents Symposia and Forums on Advanced Materials

MRS NEWS

- **64** MRS Featured Volunteer
- First MRS Workshops Cover Tribology and Advances in Thin Film Simulations and Experimental Verification
- 68 Preview: 1999 MRS Fall Meeting
- 70 Nobel Laureate Stormer to Give Plenary Talk on Fractional Quantum Numbers
- 71 Richard S. Stein to Receive 1999 Von Hippel Award for Contributions to the Science of Polymers
- 72 Joe Greene Selected for 1999 David Turnbull Lectureship for Contributions to the Science of Thin Films
- 73 Craford, Forrest Named 1999 MRS Medalists

ABSTRACTS

102 Abstracts for November 1999

Journal of Materials

Research

DEPARTMENTS

6 Material Matters

Higher Education and Science Reform (HESR) Program Advances Materials Research in Estonia, E. Mellikov and A. Öpik

- 9 Research/Researchers
- 15 Washington News
- 16 Public Affairs Forum
- 17 Editor's Choice
- 18 Resources
- 26 Advertisers in This Issue
- 101 Library

The Structure of Materials, S.L. Allen and E.L. Thomas, and Physics of Materials, Y. Quéré, reviewed by R.W. Cahn

109 Classified

ON THE COVER: Materials Science of the Cell: (Bottom) Layout of a generic animal cell, showing structural elements such as the plasma membrane and the cytoskeleton as well as a selection of organelles. See article on page 27. (Center left) Various manipulations of cells using microplates (size marker is 5 µm). See article on page 22. (Top left) Lipid vesicle held in a micropipet (pipet diameter $D_0 \sim 8 \mu \text{m}$, vesicle diameter $D_v \sim 25 \mu \text{m}$, and projection length $L\sim 12~\mu m$). Graph shows tension versus area strain, giving the area-expansion modulus $K_{\rm A}$ (slope), lysis tension $T_{\rm lys}$ (maximum tension), critical strain at failure α_c (maximum strain), strain energy (area under curve), and bending modulus $k_{\rm c}$ (from the initial nonlinear part of the plot). See article on page 32.

Bulk Glass-Forming Metallic Alloys: (Top right) A high-resolution-transmissionelectron-microscope image of a glassy Mg-Y-Cu-Li sample exhibiting phase separation. Courtesy of Wenshan Liu. See article on page 42.

About the Materials Research Society

The Materials Research Society (MRS), a not-forprofit 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.

mrougn 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 multiple of Physics MRS multiple

MRS publishes symposium proceedings, MRS Bulletin, Journal of Materials Research, and other pub-

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. Periodical postage paid 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 774-779. 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 \$80 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. Requests from subscribers for missing journal issues will be honored without charge only if received within six months of the issue's actual date of publication; otherwise, the issue may be

purchased at the single-copy price.

MRS Billetin 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 BULLET

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

F I Fleischer

Managing Editor

J. Meiksin

Technical Editor

A. Bertram Wilson

Art Director

Design/Production

T. Aiello and S. Franklin

Editorial Assistants

L. Willson and M. Wilmoth

Advertising

M.E. Kaufold and D.L. Watterson

Circulation

S Forrest

Guest Editors

D. Wirtz and E. Evans

Special Contributors

P. Berardelli, M.D. Drory, G. Gilmer, D. Ila, E.N. Kaufmann, A. King, P. Leon, M.J. Mayo, M.O. Robbins,

and L. Snyder

Special Consultants

T. Besmann and C.E. Hunt

Associate Editor-Europe

I.W. Boyd, University College London Dept. of Electronic and Electrical Engineering

Torrington Place London WCI E7 JE, U.K. Tel. 44-171-380-7300 or 7302

Book Review Board

M.L. Green (Chair), R.W. Cahn, E.J. Kramer, and J.M. Phillips

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 -

A.L. Greer, Chair Cambridge University Cambridge, UK

V.S. Arunachalam Carnegie Mellon University Pittsburgh, PA

E. Arzt

Max-Planck-Institute Für Metallforschung and University of Stuttgart Stuttgart, Germany

R.W. Cahn 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

S.T. Picraux

Sandia National Laboratories Albuquerque, NM

Y. Shiohara ISTEC

Tokyo, Japan C.C. Tsai

Applied Komatsu Technology

Santa Clara, CA J.H. Westbrook **Brookline Technologies**

Ballston Spa, NY

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

2000

D.C. Martin University of Michigan Ann Arbor, MI

G.M. Pharr University of Tennessee Knoxville, TN

A. Polman FOM Institute

Amsterdam, The Netherlands

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

1999 MRS EXECUTIVE COMMITTEE

President

C.C. Tsai

R. Gibala

University of Michigan

Vice President and President-Elect

H.A. Atwater

Applied Komatsu Technology

California Institute of Technology Secretary

Treasurer M.J. Mayo

Pennsylvania State University

Immediate Past President R.J. Nemanich

North Carolina State University

Councillors M.J. Aziz

Harvard University A. Kina

Purdue University

Executive Director Materials Research Society John B. Ballance

INTERNATIONAL UNION OF MATERIALS RESEARCH SOCIETIES

President

H-D. Li Tsinghua University Beijing, China

First Vice President P.A. Glasow Erlangen, Germany

Second Vice President J.S. Williams

Secretary L-C Lee **Australian National University** Industrial Technology Research Institute Canberra, Australia

Tokvo, Japan Hsinchu, Taiwan

R-I. Yamamoto University of Tokyo **Immediate Past President** R.C. Ewing University of Michigan Ann Arbor, MI, USA

General Secretary R.P.H. Chang Northwestern University Evanston, Illinois, USA

IUMRS ADHERING BODIES

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

Chinese Materials Research Society (C-MRS) H-D. Li, Tsinghua University

European Materials Research Society (E-MRS) J. Martinez-Duart, Universidad Autónoma

Materials Research Society (MRS) R. Gibala, University of Michigan

Materials Research Society of Argentina (MRS-Argentina) J. Feugeas, Universidad Nacional de Rosario

Materials Research Society of India (MRS-I) R. Chidambaram, Atomic Energy Commission

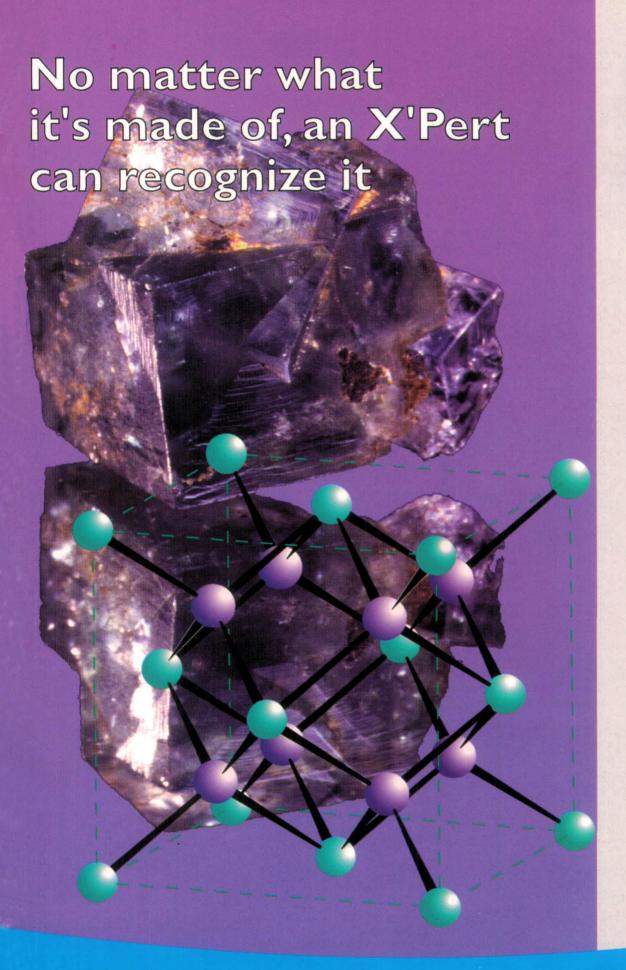
Materials Research Society of Japan (MRS-J) T. Kajiyama, Kyushu University

Materials Research Society of Korea (MRS-Korea) S-J. Park, Seoul National University

Materials Research Society of Russia (MRS-Russia) I.V. Gorynin, Prometey Institute

Materials Research Society of Taiwan (MRS-T) L.J. Chen, National Tsing Hua University

Mexican Materials Research Society (Mexican-MRS) Egberto Bedolla, Instituto de Investigaciones Metalurgicas





With the Philips X'Pert x-ray diffractometer line, you'll find a solution to even the most complex materials identification problems. X'Pert-MRD for advanced research, X'Pert-MPD for powder diffraction, stress/texture, microstructure and crystallographic studies.

A comprehensive hardware/software range offers unique features for ultimate accuracy, sensitivity, flexibility and ease of use.

For more information:

Philips Analytical

85 McKee Drive, Mahwah, NJ 07430-1921,USA Tel: +1 (201) 529-6111

Fax: +1 (201) 5295084

Internet:

http://www.analytical.philips.com

E-mail:

jennifer_gati@pei.philips.com



