

MRS BULLETIN

April 1996

A Publication of the Materials Research Society

Volume 21, Number 4 ISSN: 0883-7694 CODEN: MRSBEA

HETEROEPITAXY AND STRAIN

18 Heteroepitaxy and Strain: Applications to Electronic and Optoelectronic Materials

L.J. Schowalter, Guest Editor

21 Strain-Induced Modulations in the Surface Morphology of Heteroepitaxial Layers

A.G. Cullis

27 Effects of Stress on Step Energies and Surface Roughness

C. Roland

31 Kinetic Pathways to Strain Relaxation in the Si-Ge System

D.E. Jesson, K.M. Chen,
and S.J. Pennycook

38 The Effect of Strain on the Formation of Dislocations at the SiGe/Si Interface

F.K. LeGoues

45 Substrate Engineering with Plastic Buffer Layers

L.J. Schowalter

50 Three-Dimensional Carrier Confinement in Strain- Induced Self-Assembled Quantum Dots

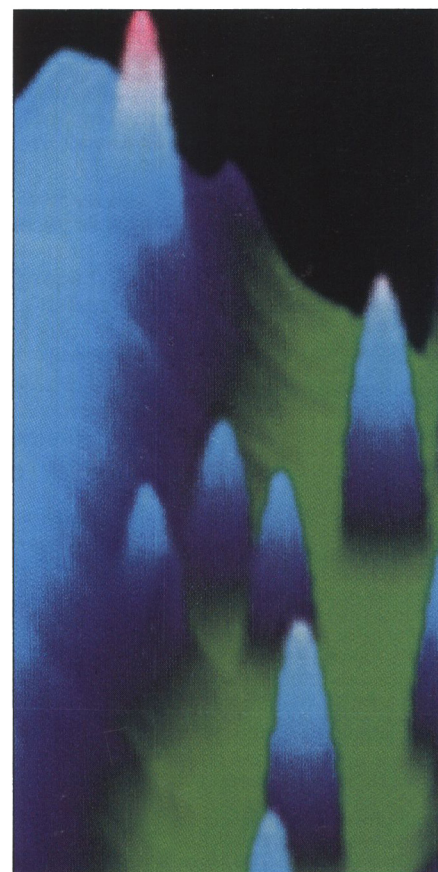
P.M. Petroff and
G. Medeiros-Ribeiro

JMR ABSTRACTS

60 Abstracts for June 1996
*Journal of Materials
Research*

DEPARTMENTS

- 3 Material Matters
- 9 Research/Researchers
- 13 Washington News
- 14 Editor's Choice
- 15 Resources
- 55 Links of Science & Technology
Rare-Earth Magnets, J.D. Livingston
- 69 Library
- 70 Advertisers in This Issue
- 70 Classified



ON THE COVER: Atomic-force micrograph of self-assembled InAs islands deposited by molecular-beam epitaxy on a patterned GaAs (100) surface. The valleys and hills that have been defined by optical lithography and etching have a period of ≈ 240 nm. The InAs islands formed by deposition of ≈ 1.5 monolayers of InAs on the corrugated GaAs surface are preferentially located in the valleys of the surface. The height and diameter of the InAs islands are 10 nm and ≈ 20 nm, respectively. These islands will be transformed into quantum dots by *in situ* overgrowth of a GaAs cladding layer. For more information, see the article by Petroff and Medeiros-Ribeiro on page 50.

About the Materials Research Society

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 over 12,000 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 60 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, 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 *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 \$135 for one calendar year (12 issues) within the U.S.A. and \$185 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/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 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
<http://www.mrs.org/>

MRS BULLETIN

Editorial Office • 9800 McKnight Road • Pittsburgh, PA 15237-6006
Tel. (412) 367-3004 x522; fax (412) 367-4373; <http://www.mrs.org/>

Editor
E.L. Fleischer

Managing Editor
J. Meiksin

Assistant Editor
L.R. Gallagher

Art Director
C. Love

Design/Production
T. Aiello and S. Franklin

Editorial Assistants
M.M. Costello and J. Dininny

Advertising
M.E. Kaufold

Circulation
S.E. Krasa

Guest Editor
J.H. Westbrook

Special Contributors
L.A. Kryszinski, H. Neff,
E. Pennisi, and R.J. Pressley

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 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

CHAIR—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
The 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
Nagasaki Institute of Applied Science
Tokyo, Japan

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

J. Soares
Universidade de Lisboa
Lisboa, Portugal

K.C. Taylor
General Motors R&D Center
Warren, Michigan, USA

MRS BULLETIN PUBLICATIONS SUBCOMMITTEE

M. Nastasi, Chair
Los Alamos National Laboratory
Los Alamos, New Mexico

R.C. Ewing
University of New Mexico
Albuquerque, New Mexico

R.L. Fleischer
Rensselaer Polytechnic Institute
Troy, New York

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

M. Libera
Stevens Institute of Technology
Hoboken, New Jersey

F. Shapiro
Drexel University
Philadelphia, Pennsylvania

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

1996 MRS EXECUTIVE COMMITTEE

President
C.V. Thompson
Massachusetts Institute of Technology

First Vice President and President-Elect
R. Hull
University of Virginia

Second Vice President and Vice President-Elect
R.J. Nemanich
North Carolina State University

Secretary
K.S. Jones
University of Florida

Treasurer
A.K. Hays
Sandia National Laboratories

Immediate Past President
J.M. Phillips
Sandia National Laboratories

Councillors
R. Gibala
University of Michigan

A.I. Taub
Ford Research Laboratory

Executive Director
Materials Research Society
John B. Ballance

INTERNATIONAL UNION OF MATERIALS RESEARCH SOCIETIES

President	Vice President	Secretary	Treasurer	Immediate Past President	General Secretary
M. Doyama Nishi-Tokyo University Tokyo, Japan	R.C. Ewing University of New Mexico Albuquerque, New Mexico USA	G-C. Chi National Central University Chung-Li, Taiwan	G.M. Crean University College Cort, Ireland	P. Siffert Centre de Recherches Nucléaires Strasbourg, France	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) P. Rama Rao, Technology Bhavan		Materials Research Society of Russia (MRS-Russia) I.V. Gorynin, Prometey Institute	
Chinese Materials Research Society (C-MRS) H-D. Li, National Science Foundation—China		Materials Research Society of Japan (MRS-J) T. Takagi, Ion Engineering Research Institute Corp.		Materials Research Society of Taiwan (MRS-T) L.J. Chen, National Tsing Hua University	
European Materials Research Society (E-MRS) P.A. Glasow, Siemens AG		Materials Research Society of Korea (MRS-Korea) J-T. Song, Hanyang University		Mexican Materials Research Society (Mexican-MRS) L.M. Gomez, Instituto de Fisica-Cuernavaca, UNAM	
Materials Research Society (MRS) C.V. Thompson, Massachusetts Institute of Technology					