

MRS BULLETIN

February 1990

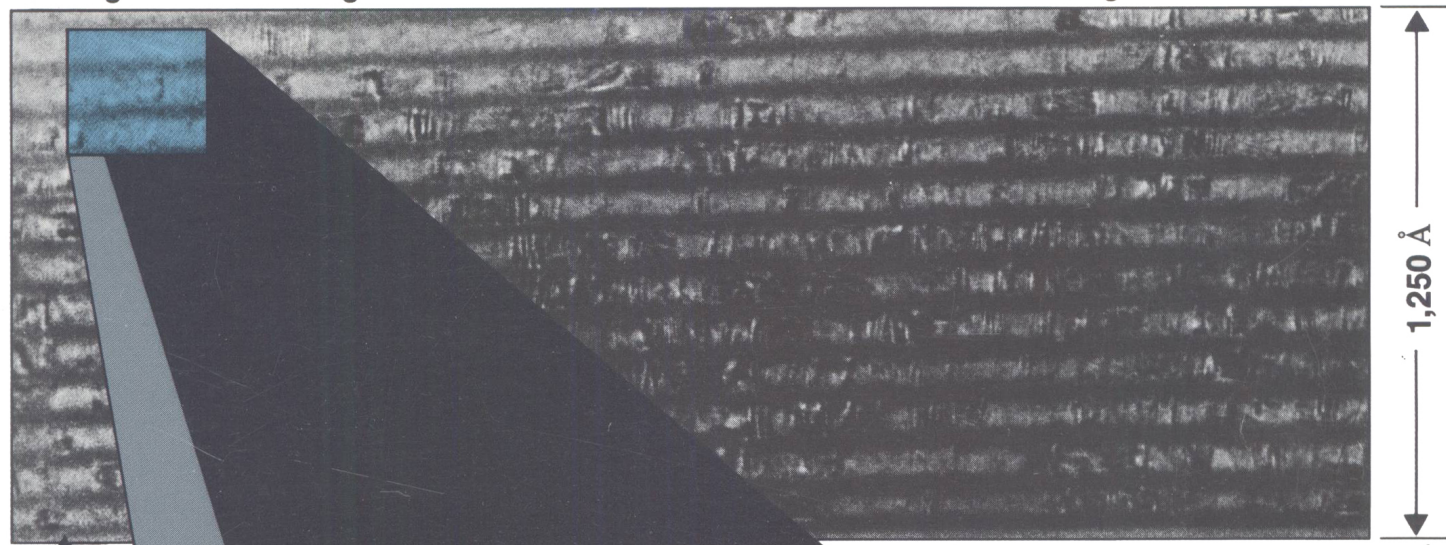
Volume XV, Number 2

Serving the International Materials Research Community

Multilayer Materials

Low Magnification Showing Overall Structure

Magnification: 540,000X



Substrate

Dark Layers - Amorphous Nickel-Titanium 40 Å
Light Layers - Crystalline Titanium 63 Å

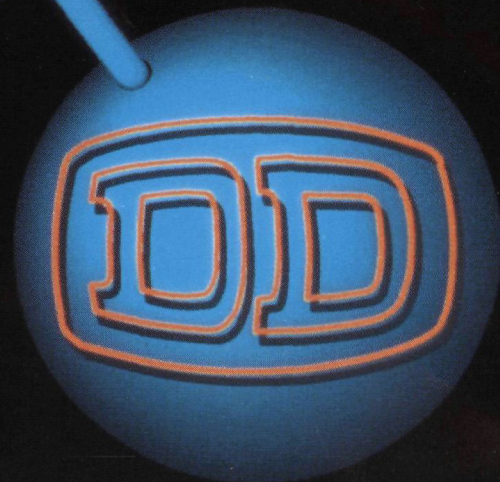
High Magnification
Showing Lattice Detail

- ◀ Titanium 63 Å (crystalline)
- ◀ Nickel Titanium 40 Å
- ◀ Titanium 63 Å
- ◀ Nickel Titanium 40 Å
- ◀ Titanium 63 Å

~300 Å

Magnification: 2,700,000X

A NEW CLUSTER IS BORN



General Ionex acquired by High Voltage Engineering Europa B.V.

In December 1987 High Voltage Engineering Europa B.V. (HVEE) acquired Dowlish Developments Ltd (DD), an accelerator tube manufacturer located in the United Kingdom.

On April 10, 1989, HVEE purchased the General Ionex Analytical Product Group from Genus Inc. based in the United States.

Through this acquisition HVEE positions itself as the largest and most diverse manufacturer of particle accelerators for the scientific and industrial research communities.

The acquired General Ionex (GI) product lines, which include the Tandetron accelerator systems and Model 4175 RBS Analyser, will be manufactured in HVEE's new, well-equipped facility in Amersfoort, The Netherlands.

World wide marketing of all products from HVEE, DD and GI will originate from HVEE Amersfoort with sales and service offices in the USA, Europe and Japan.

After addition of the newly acquired products HVEE's product lines include:

– *Ion Accelerator Systems*

- Air insulated accelerators up to 500 kV
- Single ended Van de Graaff accelerators up to 4 MV
- Tandem Tandetron accelerators up to 3 MV/TV

– *Research ion implanters*

- Beam energies 10 keV-9 MeV and higher

– *Systems for ion beam analysis*

- Systems for RBS, PIXE, PIGE, NRA, ERD, MACS and MEIS

– *Components*

- HV power supplies, electron and ion accelerator tubes, ion sources beamline components, beam monitoring equipment, UHV sample manipulators, etc.

For further information on this transaction and product literature please contact HVEE in Amersfoort/NL.



**More
Energy for Research**

HIGH VOLTAGE ENGINEERING EUROPA B.V.

Published online by Cambridge University Press
P.O. Box 99, 3800 AB Amersfoort, The Netherlands. Phone: (+31) 33 - 619741. Fax: (+31) 33 - 615291. Telex: 79100 HIVEC NL
Sales Office for USA & CANADA: Peabody Scientific, P.O. Box 2009, Peabody, MA 01960, USA Phone: (508) 535-0444, Fax: (508) 535-5827

MRS BULLETIN

February 1990

A Publication of the Materials Research Society

Volume XV, Number 2 ISSN: 0883-7694 CODEN: MRSBEA

MULTILAYER MATERIALS

- 17 Multilayer Materials**
Troy W. Barbee Jr., Guest Editor
- 19 Metastable Phase Formation in Thin Films and Multilayers**
Bruce M. Clemens and Robert Sinclair
- 29 Artificially Layered Superconductors**
Ivan K. Schuller, J. Guimpel, and Y. Bruynseraede
- 37 Multilayer Optics for the Soft X-Ray and Extreme Ultraviolet**
Troy W. Barbee Jr.

SPECIAL FEATURE

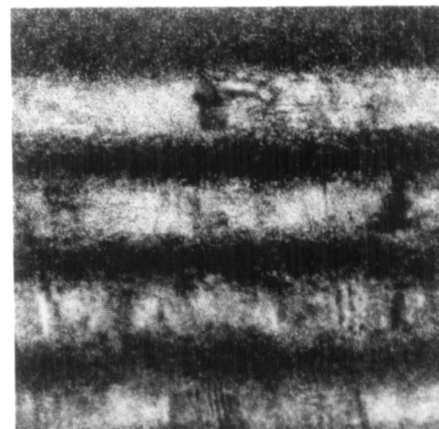
- 63 Upclose: Center for Advanced Materials Processing at Clarkson University**
S.K. Ellis and E.P. McNamara Jr.

MRS NEWS

- 46 Preview: 1990 Spring Meeting**
- 53 Chianelli Assumes MRS Presidency in 1990**
- 56 Boston Meeting Attracts Worldwide Audience**
- 61 Paul Siffert Receives Woody Award**
- 61 Graduate Student Award Winners Honored at Fall Meeting**
- 62 MRS Council Meets in Boston**

DEPARTMENTS

- 4 Material Matters**
- 7 Research/Researchers**
- 12 Research Resources**
- 15 From Washington**
- 16 Editor's Choice**
- 66 Historical Note**
- 68 Section News**
- 69 Chapter News**
- 72 Book Reviews**
- 73 Advertisers in this Issue**
- 74 Calendar**
- 78 Classified**



ON THE COVER: Transmission electron lattice image of a titanium (Ti) - nickel titanium (NiTi) multilayer synthesized by magnetron sputtering. The multilayer contains 100 periods of 63 Å Ti and 40 Å NiTi. The Ti layers are crystalline with a (00.1) fiber texture while the NiTi layers are amorphous. The (00.1) Ti planes are lattice imaged in this micrograph. The grazing incidence thermal neutron reflectivity of this multilayer microstructure superlattice was measured to be >95% using facilities at the National Institute for Science and Technology. Model calculations predict thermal neutron reflectivities of ~99.6% as the neutron optical constants of Ti and Ni are very well suited to this application. The micrograph was taken by Mark A. Wall of Lawrence Livermore National Laboratory using a top-entry JEOL 200 CX transmission electron microscope at the National Center for Electron Microscopy, Lawrence Berkeley Laboratory.

MRS BULLETIN

Materials Research Society • 9800 McKnight Road • Pittsburgh, PA 15237

MRS BULLETIN

Editor

G. A. Oare
(412) 367-3036

Assistant Editor

F. M. Wieloch
(412) 367-3036

Copy Editor

S. W. Morelli

Design/Production

C. Love, W. Appman
(412) 367-3003

Editorial Assistant

J. Dininny
(412) 367-3036

Advertising and Circulation

M. E. Kaufold
(412) 367-3036

Associate Editor—Europe

I. W. Boyd
University College London
Dept. of Electronic and
Electrical Engineering
Torrington Place
London WC1 E7 JE
United Kingdom
01-387-7050
ext. 3956 or 7304

Contributor

K. J. Anderson

Guest Editor

T. W. Barbee Jr.

Chairman—Editorial Boards

E. N. Kaufmann
Argonne National Laboratory
Argonne, Illinois

International Advisory Board

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

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

R. Krishnan
Defense Research and
Development Organization
New Delhi, India

H. D. Li
Tsinghua University
Beijing, China

R. Roy
Pennsylvania State University
University Park, Pennsylvania

G. D. W. Smith
University of Oxford
Oxford, United Kingdom

T. Sugano
University of Tokyo
Tokyo, Japan

J. S. Williams
Royal Melbourne Institute of
Technology
Melbourne, Australia

1990 MRS EXECUTIVE COMMITTEE

President

R. R. Chianelli
Exxon Research
and Engineering

First Vice President and President-Elect

J. B. Roberto
Oak Ridge National
Laboratory

Second Vice President

S. Cargill
IBM T.J. Watson
Research Center

Executive Director
Materials Research Society
John B. Ballance

Secretary

C.M. Jantzen
Westinghouse Savannah
River Co.

Treasurer

S. M. Kelso
Therma-Wave, Inc.

Immediate Past President

R. P. H. Chang
Northwestern University

Technical Editorial Board

J. C. C. Fan
Kopin Corporation
Taunton, Massachusetts

F. Y. Fradin
Argonne National Laboratory
Argonne, Illinois

G. L. Liedl
Purdue University
West Lafayette, Indiana

S. Namba
Osaka University
Osaka, Japan

R. L. Schwoebel
Sandia National Laboratories
Albuquerque, New Mexico

R. C. Sundahl
Intel Corporation
Chandler, Arizona

K. C. Taylor
General Motors
Warren, Michigan

EUROPEAN MRS

P. Siffert

Centre de Recherches Nucléaires
Laboratoire PHASE
67037 Strasbourg, Cedex, France
Telephone: (88) 28 65 43
Fax: (88) 28 09 90

MRS BULLETIN

Publications Subcommittee

M. H. Bennett-Lilley
Texas Instruments
Dallas, Texas

R. R. Chianelli
Exxon Research and Engineering
Annandale, New Jersey

R. J. Eagan
Sandia National Laboratories
Albuquerque, New Mexico

P. Sliva
General Electric
Largo, Florida

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

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

ABOUT THE MATERIALS RESEARCH SOCIETY

The Materials Research Society (MRS) is a nonprofit scientific association founded in 1973 to promote interdisciplinary goal-oriented basic research on materials of technological importance. Membership in the Society includes more than 9,500 scientists from industrial, government, and university research laboratories in the United States and more than 25 countries.

The Society's interdisciplinary approach to the exchange of technical information is qualitatively different from that provided by single-discipline professional societies because it promotes technical exchange across the various fields of science affecting materials development. MRS sponsors two major international annual meetings encompassing approximately 40 topical symposia, as well as numerous single-topic scientific meetings each year. It recognizes professional and technical excellence, conducts short courses, and fosters technical exchange in various local geographic regions through Section activities and University Chapters.

MRS is an Affiliated Society of the American Institute of Physics and participates in the international arena of materials research through associations with professional organizations such as European MRS.

MRS publishes symposium proceedings, the *MRS BULLETIN*, *Journal of Materials Research*, and other current scientific developments.

MRS BULLETIN (ISSN: 0883-7694) is published 12 times a year by the Materials Research Society, 9800 McKnight Road, Pittsburgh, PA 15237. Membership in MRS includes \$25.00 (\$15.00 for students) from membership dues to be applied to a subscription to the *MRS BULLETIN*. Application to mail at second class rates is pending at Pittsburgh, PA and at additional mailing offices. POSTMASTER: Send address changes to *MRS BULLETIN* in care of the Materials Research Society, 9800 McKnight Road, Pittsburgh, PA 15237; telephone (412) 367-3003; fax (412) 367-4373.

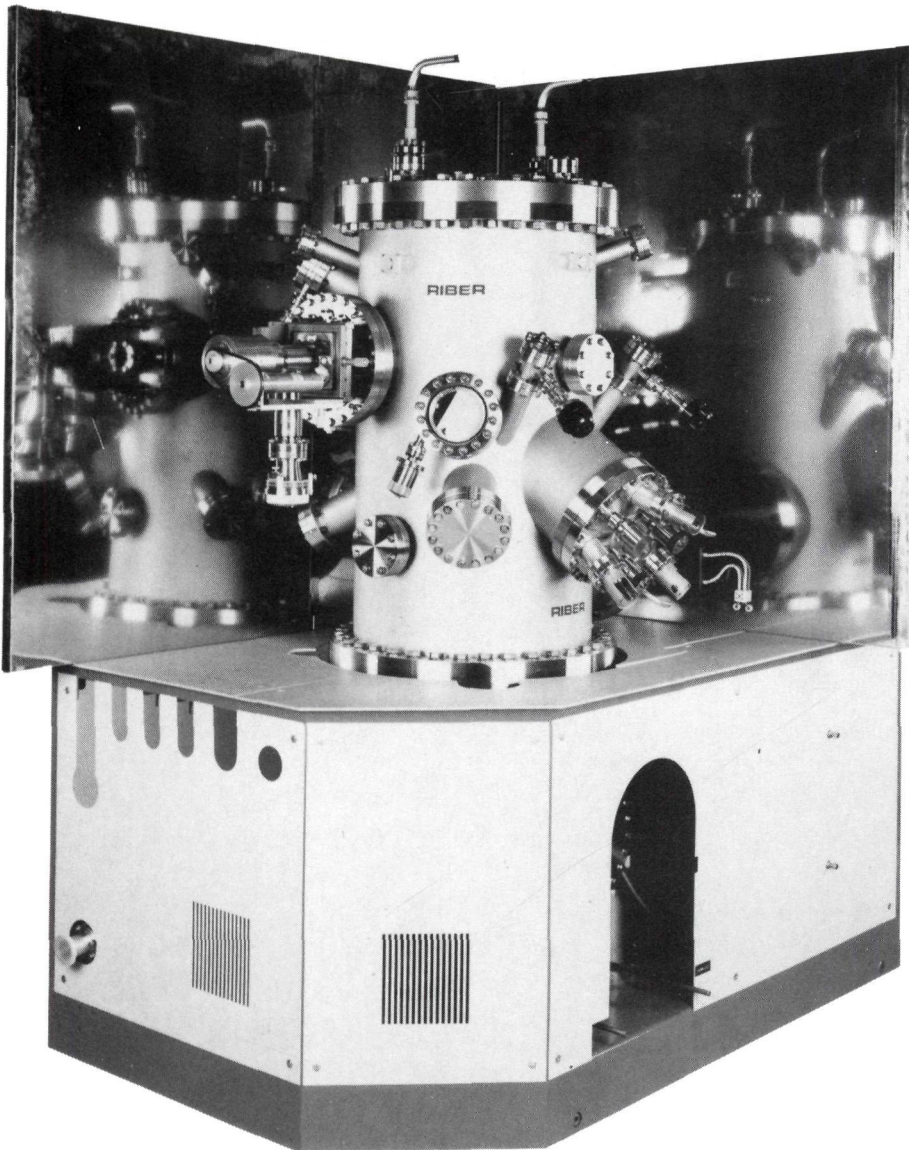
Back volumes of this publication are available in 16mm microfilm, 35mm microfilm, or 105mm microfiche through University Microfilms Inc., 300 North Zeeb Road, Ann Arbor, Michigan 48106.

RIBER EVA 32

SUPERCONDUCTORS: A PROVEN UHV DEPOSITION SYSTEM FOR SUPER- CONDUCTING THIN FILMS.

Superconducting thin films have been successfully grown and characterized in Riber systems for more than four years. Similar instrumental characteristics are required to grow the new high T_c materials:

- Precise substrate temperature control
- Precise composition control
- Impurity-free growth environment
- Flake-free growth chamber
- Compatible with any type of substrate
- Cuprate deposition process experience
- Refractory metal buffer layer capability
- Immediate analysis by XPS and Auger



Please visit Booth Nos. 212, 214 at the MRS Show in San Francisco, April 16-21, 1990.



For more information
call (201) 494-8660

Riber Division of Instruments SA, Inc.
6 Olsen Avenue, Edison, NJ 08820
Telex 844516 FAX (201) 494-8796

RIBER, Division d'Instruments S.A. 133-137, boulevard National
Rueil-Malmaison, France B.P. 231 — 92503 Rueil Cedex
Tel. (1) 47.08.92.50 — Telex 203.367F

Printed in USA 1M 1987