



LAWRENCE  
LIVERMORE  
NATIONAL  
LABORATORY

# Introduction to IBMM 2004

Bob Averback, Tomas Dias de la Rubia, Tom Felter, Alex Hamza, Lynn Rehn

October 10, 2005

Ion Beam Modification of Materials, 2004  
Pacific Grove, CA, United States  
September 5, 2004 through September 10, 2004

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

This work was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

# Ion Beam Modification of Materials

UCRL-CONF-216018

Proceedings of the 14th International Conference on Ion Beam Modification of Materials

Asilomar Conference Center in Pacific Grove, California, USA

September 5-10, 2004

## *Editors*

R.S. Averback, University of Illinois, Department of Materials Science & Engineering, Urbana, IL 61801 USA

T.D. de la Rubia, Lawrence Livermore National Laboratory, Chemistry and Materials Science Directorate, Livermore, CA 94550 USA

T.E. Felter, Lawrence Livermore National Laboratory, Division of Materials Science and Technology, Chemistry and Materials Science Directorate, Livermore, CA 94550 USA

A.V. Hamza, Lawrence Livermore National Laboratory, Division of Materials Science and Technology, Chemistry and Materials Science Directorate, Livermore, CA 94550 USA

L.E. Rehn, Argonne National Laboratory, Division of Materials Science, Argonne, IL 60439 USA

## Editorial

This volume contains the proceedings of the 14th International Conference on Ion Beam Modification of Materials, IBMM 2004, and is published by Elsevier-Science Publishers as a special issue of *Nuclear Instruments and Methods B*. The conference series is the major international forum to present and discuss recent research results and future directions in the field of ion beam modification, synthesis and characterization of materials. The first conference in the series was held in Budapest, Hungary, 1978, and subsequent conferences were held every two years at locations around the Globe, most recently in Japan, Brazil, and the Netherlands. The series brings together physicists, materials scientists, and ion beam specialists from all over the world. The official conference language is English.

IBMM 2004 was held on September 5-10, 2004. The focus was on materials science involving both basic ion-solid interaction processes and property changes occurring either during or subsequent to ion bombardment and ion beam processing in relation to materials and device applications. Areas of research included Nanostructures, Multi-scale Modeling, Patterning of Surfaces, Focused Ion Beams, Defects in Semiconductors, Insulators and Metals, Cluster Beams, Radiation Effects in Materials, Photonic Devices, Ion Implantation, Ion Beams in Biology and Medicine including New Materials, Imaging, and Treatment.

The conference organizers carefully considered suggestions from the community in setting the main themes of the conference. These themes were reflected by the choice of invited speakers. However, about 50% of the slots for invited speakers were kept open for later selection from the submitted abstracts. Invited speakers were chosen on the basis of the quality of the research, geographical representation and fair representation of the ion-beam community. Abstracts for oral presentation were selected on a similar basis while providing coherent sessions was also an important consideration. We included a large poster session and avoided parallel oral sessions.

200 scientists from around the world attended our conference. The largest representation was from the US with 60, closely followed by Japan, 51 and Germany 20. Ten attendees came from France, eight from Australia, and six each from Canada, Italy and the United Kingdom. Brazil and the Netherlands each sent five attendees while Portugal sent four and Finland three. Two attendees came from Austria, Belgium, Mexico, Taiwan, and Spain. China, Hong Kong, India, Poland, Sweden, and Thailand were also represented.

The Asilomar Conference Center in Pacific Grove, California, USA served as the perfect facility for IBMM 2004. Asilomar is 120 miles south of San Francisco along the rugged coastline of the Monterey Bay. Asilomar is an inexpensive facility with family style meals augmented for IBMM 2004 with a conference banquet and awards ceremony, an outdoor reception with music and campfire with marshmallows. Conference participants rented bikes and sea kayaks before or after the conference or walked to the nearby beach. Asilomar is also an architectural showcase for the works of two of America's most prestigious architects: Julia Morgan (designed Hearst Castle) and John Carl Warneke

(designed President John F. Kennedy memorial grave site). Other attractions included the Monterey Bay Aquarium and Cannery Row, Pebble Beach and the 17-Mile Drive, as well as the Carmel Mission. Also noteworthy are several local wineries and world-class golf courses. A Conference banquet was held during the meeting and plaques of recognition were awarded to H. H. Andersen and L. Rehn for their dedication as editors for Nuclear Instruments and Methods B establishing a unique archival resource on worldwide ion beam science and technology. Also, Ch. Trautmann was welcomed as a new Editor for the journal.

During the business meeting of the International Committee, Prof. Francesco Priolo, Università di Catania, successfully bid on hosting IBMM 2006 and Prof. André Vantomme, Leuven University (Belgium), was elected to the International Committee. IBMM 2006 will be held in Taormina (Sicily), September 18-22, 2006.

IBMM 2004 organizers are greatly indebted to the Northern California Chapter of the American Vacuum Society, NCCAVS, and their staff, notably Della Miller and Heather Korff, for help with the conference organization and planning as well as with the myriad of details involved with the conference and website. We also thank the Celtic Knots and the Connie Doolan Band for music at the reception and banquet. We especially thank the presenters, the authors, the referees, and the audience for making the conference such a successful scientific meeting. The LLNL work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

Bob Averback, Tomas Diaz de la Rubia, Tom Felter, Alex Hamza, and Lynn Rehn, *Guest Editors*

*IBMM International Committee*

H.H. Andersen, Denmark  
J.C. Barbour, USA  
M. Behar, Brazil  
H. Bernas, France  
R. Elliman, Australia  
K. Gamo, Japan  
N. Gerasimenko, Russia  
M. Iwaki, Japan  
J.W. Mayer, USA  
W. Möller, Germany  
M.A. Nastasi, USA  
A. Polman, The Netherlands  
F. Priolo, Italy  
S. Roorda, Canada  
B. Sealy, UK  
A. Vantomme, Belgium  
I. Yamada, Japan  
Xi Wang, China

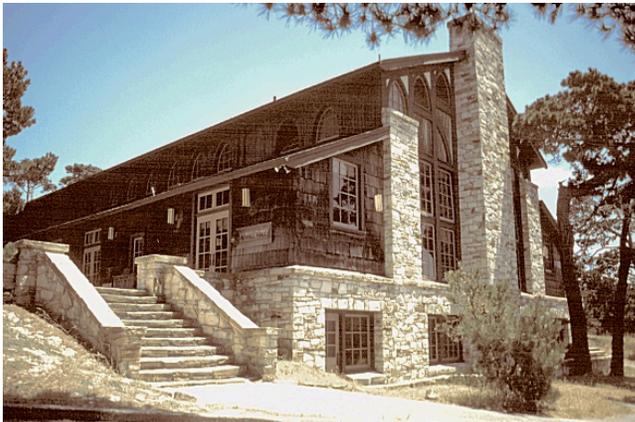
*IBMM Honorary Members:*

W.L. Brown, USA  
G.W. Carter, UK  
W.K. Chu, USA  
J. Davies, Canada  
A. Golanski, France  
J. Gyulai, Hungary  
T. Itoh, Japan  
T.E. Jackman, Canada  
J. Kelly, Australia  
O. Meyer, Germany  
S. Namba, Japan  
S.T. Picraux, USA  
E. Rimini, Italy  
F.W. Saris, The Netherlands  
B. Stritzker, Germany  
P.D. Townsend, UK  
V. Vavilov, Russia  
C.W. White, USA  
Shichang Zou, China

*2004 Organizing Committee:*

*Chairs:*

Bob Averback, University of Illinois  
Tomas Diaz de la Rubia, Lawrence Livermore National Laboratory  
Tom Felter, Lawrence Livermore National Laboratory  
Alex Hamza, Lawrence Livermore National Laboratory  
Lynn Rehn, Argonne National Laboratory



**IBMM 2004 oral and poster sessions were held in structures designed for Asilomar by Julia Morgan: the Chapel (1915) and Merrill Hall (1928), shown above.**