The HF5000 200 kV Cold FEG Aberration-Corrected TEM/STEM + SEM
The Innovative 200 kV TEM/STEM + SEM Is Here!

Three imaging modes (TEM/STEM + SEM) integrated into one system with automated aberration correction

The Hitachi HF5000 TEM/STEM + SEM with aberration-corrected STEM/SEM accommodates simultaneous acquisition of surface and transmission images at sub-atomic resolution. Surpassing traditional TEM/STEM imaging, the HF5000's proprietary SE capability can image surfaces of both transmissive and bulk samples while providing simultaneous EDS analysis. Hitachi’s own highly automated and probe-forming aberration correction is designed specifically to make sub-Å imaging easy.

Our unique cold field-emission gun technology delivers high brightness, extended stability of the probe current, and leading-energy resolution without a monochromator. With the availability of dual X-ray detectors, we guarantee fast and highly sensitive EDS analyses. EELS and many other options are available.

For more details, contact us at: microscopy@hitachi-hta.com

Hitachi High Technologies America, Inc.      www.hitachi-hightech.com/us     Tel. 800-253-3053

© 2017 Hitachi High Technologies America, Inc. All rights reserved.
What have we achieved in this period?

- **ultra 45˚** the first diamond knife with an absolutely score-free, hydrophilic cutting edge.
- **semi** the first diamond knife for alternating sectioning ultrathin/semithin.
- **cryo** the diamond knife for sectioning at low temperature.
- **histo** the first diamond knife for semithin sections for light microscopy.
- **ultra 35˚** the diamond knife for optimized sectioning results in almost all applications.
- **STATIC LINE II** the ionizer for eliminating electrostatic charging in ultramicrotomy.
- **cryo-P** a cryo knife with a patented platform for section pick up.
- **cryo immuno** the optimized cryo diamond knife for the Tokuyasu technique.
- **ultra sonic** the oscillating diamond knife for room temperature sectioning.
- **cryotrim** 45 and 25 optimizing trimming with diamond blades.
- **ultra sonic** the first diamond knives for AFM at room and low temperatures.
- **cryo 25˚** for sectioning frozen hydrated specimens.

What services can we offer you?

- Technical assistance in all fields of ultramicrotomy.
- Free sectioning tests for all types of samples.
- Make use of our many years of experience in perfecting our knives.
- Custom knives, tools, and boats.
- Special purchase programs.
- Workshops and training.

**Spacious Labs**
**State-of-the-Art Equipment**
**Certified Instructors**
**New Equipment Demos**

**COURSES**
- Aurion Immuno Gold
- Biological SEM
- Biological TEM
- Cryosectioning/Immunogold
- Cryo SEM
- Materials Ultramicrotomy
- Pharma Applications
- Pharma Polymorphism
- X-Ray Microanalysis

**VISIT OUR WEBSITE TO MAKE A COURSE REQUEST...**

**www.emsdiasum.com**

**DiATOME DIAMOND KNIVES**

**40 YEARS OF DEVELOPMENT, MANUFACTURING, AND CUSTOMER SERVICE**

What have we achieved in this period?

- **ultra 45˚** the first diamond knife with an absolutely score-free, hydrophilic cutting edge.
- **semi** the first diamond knife for alternating sectioning ultrathin/semithin.
- **cryo** the diamond knife for sectioning at low temperature.
- **histo** the first diamond knife for semithin sections for light microscopy.
- **ultra 35˚** the diamond knife for optimized sectioning results in almost all applications.

**STATIC LINE II** the ionizer for eliminating electrostatic charging in ultramicrotomy.

- **cryo-P** a cryo knife with a patented platform for section pick up.
- **cryo immuno** the optimized cryo diamond knife for the Tokuyasu technique.
- **ultra sonic** the oscillating diamond knife for room temperature sectioning.
- **cryotrim** 45 and 25 optimizing trimming with diamond blades.
- **ultra AFM & cryo AFM** the first diamond knives for AFM at room and low temperatures.
- **cryo 25˚** for sectioning frozen hydrated specimens.

**VISIT OUR WEBSITE TO MAKE A COURSE REQUEST...**

**www.emsdiasum.com**

**Announcing the EMS Microscopy Academy**

We are excited to announce that our new academy is now open! We are now offering training courses and workshops led by our certified faculty. Located next to our extensive warehouse in Hatfield, PA, just minutes from Philadelphia, we are now also offering demonstrations of new equipment. Take advantage of the knowledge Electron Microscopy Sciences is now able to provide and the valuable information you will gain.

"An abundance of practical info, built on the necessary theoretical background!"

---

**COURSES**
- Aurion Immuno Gold
- Biological SEM
- Biological TEM
- Cryosectioning/Immunogold
- Cryo SEM
- Materials Ultramicrotomy
- Pharma Applications
- Pharma Polymorphism
- X-Ray Microanalysis

**VISIT OUR WEBSITE TO MAKE A COURSE REQUEST...**

**www.emsdiasum.com**

**EMS Microscopy Sciences**
P.O. Box 550 • 1560 Industry Rd. • Hatfield, Pa 19440
Tel: (215) 412-8400
Fax: (215) 412-8450
email: sgkkcck@aol.com

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**

**DiATOME**

**for all your sectioning requirements**
Editorial Board

Ralph Albrecht  
Ilke Arslan  
Mary Grace Burke  
Barry Carter  
Wah Chiu  
Marc De Graef  
Niel de Jonge  
Elizabeth Dickey  
Mark Ellisman  
Pratibha Gai  
Marija Gajdardziska-Josifovska  
Paul Kotula  
William Landis  
Charles Lyman  
Dale Newbury  
Robert Price  
Jean-Paul Revel  
David Smith  
Nan Yao  
Nestor Zaluzec

University of Wisconsin, Madison, Wisconsin  
Pacific Northwest Laboratory, Richland, Washington  
University of Manchester, Manchester, UK  
University of Connecticut, Storrs, Connecticut  
Baylor College of Medicine, Houston, Texas  
Carnegie Mellon University, Pittsburgh, Pennsylvania  
INM Institute for New Materials, Saarbrücken, Germany  
North Carolina State University, Raleigh  
University of California at San Diego, San Diego, California  
University of York, United Kingdom  
University of Wisconsin-Milwaukee, Milwaukee, Wisconsin  
Sandia National Labs, Albuquerque, New Mexico  
University of Akron, Akron, Ohio  
Lehigh University, Bethlehem, Pennsylvania  
National Institute of Standards and Technology, Gaithersburg, Maryland  
University of South Carolina, Columbia, South Carolina  
California Institute of Technology, Pasadena, California  
Arizona State University, Tempe, Arizona  
Princeton University, Princeton, New Jersey

Founding Editor

Jean-Paul Revel  
California Institute of Technology, Pasadena, California

Previous Editors-in-Chief

Dale Johnson  
Charles Lyman  
Robert L. Price

University of South Florida, Tampa, Florida  
Lehigh University, Bethlehem, Pennsylvania  
University of South Carolina, Columbia, South Carolina

This journal is part of the Cambridge Core service. Access to online tables of contents and article abstracts is available to all researchers at no cost. Access to full-text articles online is provided to those with online subscription. Online subscriptions must be activated. Once your subscription is activated, free access to past, present, and forthcoming articles is available at:

Microscopy and Microanalysis website: cambridge.org/MAM.

Instructions for authors submitting manuscripts may be found at cambridge.org/MAM. Select “Further Information” then select “Instructions for Contributors.” An abbreviated version of these instructions will be published in the first issue (February) of each volume.
EDAX EDS Systems with New SDD Options
Advanced Analysis with Superior Results

• Choice of optimized SDDs to suit your materials analysis needs
• Best light element sensitivity with silicon nitride (Si₃N₄) window
• Vacuum encapsulated module
• Highest throughput SDD available, with unparalleled resolution
• Safe for plasma cleaning
Microscopy and Microanalysis

Microscopy and Microanalysis publishes original research papers dealing with a broad range of topics in microscopy and microanalysis. These include articles describing new techniques or instrumentation and their applications, as well as papers in which established methods of microscopy or microanalysis are applied to important problems in the fields of biology or materials science. Microscopy and microanalysis are defined here in a broad sense, and include all current and developing approaches to the imaging and analysis of microstructure. The criteria for acceptance of manuscripts are the originality and significance of the research, the quality of the microscopy or microanalysis involved, and the interest for our readership.

Four types of communications are published in the Journal. Regular Articles are of substantial length and describe the findings of an original research project that satisfies the aims and scope of the Journal, described above. Review Articles summarize the current status of an important area within the aims and scope of the Journal. Letters to the Editor usually contain comments on recent articles that have appeared in the Journal. Book Reviews are also published, but these are solicited only through the Book Review Editor.

Instructions for Contributors

Instructions for authors contributing manuscripts may be found at http://mc.manuscriptcentral.com/mam under "Resources: Instructions and Forms." Authors may also visit cambridge.org/mam, select "Information," and then select "Instructions for Contributors." An abbreviated version of these instructions will be published in the first issue (February) of each volume.

Copyright Information

Submission of a manuscript implies: that the work described has not been published before (except in the form of an abstract or as part of a published lecture, review, or thesis); that it is not under consideration for publication elsewhere; that its publication has been approved by all coauthors, if any, as well as by the responsible authorities at the institute where the work has been carried out; that, if and when the manuscript is accepted for publication, the authors agree to transfer exclusive transfer of the copyright to the Microscopy Society of America; that the manuscript will not be published elsewhere in any language without the consent of the copyright holders; and that written permission of the copyright holder is obtained by the authors for material used from other copyrighted sources. All articles published in this journal are protected by copyright, which covers the exclusive rights to reproduce and distribute the article (e.g., as offprints), as well as all translation rights. No material published in this journal may be reproduced photographically or stored on microfilm, in electronic data bases, video disks, etc., without first obtaining written permission from the publisher. The use of general descriptive names, trade names, trademarks, etc., in this publication, even if not specifically identified, does not imply that these names lack protection by the relevant laws and regulation. Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by Cambridge University Press, provided that the appropriate fee is paid directly to Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, USA (Tel: (508) 750-8400), stating the ISSN (1431-9276), the volume, and the first and last page numbers of each article copied. The copyright owner’s consent does not include copying for general distribution, promotion, new works, or resale. In these cases, specific written permission must first be obtained from the publisher.

Disclaimer

The Microscopy Society of America, the other societies stated, and Cambridge University Press cannot be held responsible for errors or for any consequences arising from the use of the information contained in this journal. The appearance of scientific reports and/or workshops, or any other material in Microscopy and Microanalysis does not constitute an endorsement or approval by The Microscopy Society of America of any other aspect of the content of such articles. The appearance of advertising in Microscopy and Microanalysis does not constitute an endorsement or approval by The Microscopy Society of America of the quality or value of the products advertised or any of the claims, data, conclusions, recommendations, procedures, results, or any other information included in the advertisements. While the advice and information in this journal is believed to be true and accurate at the date of its going to press, neither the authors, the editors, nor the publisher can accept any legal responsibility for any errors or omissions that may be made.

Subscription Information

Microscopy and Microanalysis is published bimonthly in February, April, June, August, October, and December by Cambridge University Press. Three supplements (Meeting Guide, Program Guide, and Proceedings) are published in June and August.

Society Rates: Members of the Microscopy Society of America should contact the MSA Business Office for all subscription inquiries: Microscopy Society of America, 11130 Sunrise Valley Dr, Suite 350, Reston, VA 20191, Tel.: (703) 234-4115, Email: associationmanagements@microscopy.org, URL: www.microscopy.org. Members of other affiliated societies should contact their respective society business offices for all subscription inquiries.

Subscription Rates: Institutions print and electronic: US $2251.00 in the USA, Canada, and Mexico; UK £1354.00 + VAT elsewhere. Institutions only: US $1460.00 in the USA, Canada, and Mexico; UK £883.00 + VAT elsewhere. Individuals print plus online: US $658.00 in the USA, Canada, and Mexico; UK £400.00 + VAT elsewhere. Prices include postage and insurance.

USA, Canada, and Mexico: Subscribers in the USA, Canada, and Mexico should send their orders, with payment in US dollars or the equivalent value in Canadian dollars, to: Cambridge University Press, Customer Services Department (Journals), 1 Liberty Plaza, New York, NY 10006, USA. Tel: (845) 353-7500. Fax: (845) 353-4141. Orders may be phoned direct (toll free): (800) 872-7423. E-mail: journals_subscriptions@cup.org.

Outside North America: Subscribers elsewhere should send their orders, with payment in sterling, to: Customer Services Department (Journals), Cambridge University Press, University Printing House, Shaftesbury Road, Cambridge, CB2 8BS, UK. Tel: +44 (0)1223 326670. Fax: 44 (0)1223 325150. E-mail: journals@cambridge.org

Change of address: Allow six weeks for all changes to become effective. All communications should include both old and new addresses (with postal codes) and should be accompanied by a mailing label from a recent issue. Society members should contact their respective society business offices to inform them of address changes.

Editorial Office

John Mansfield, Editor in Chief, 4304 Spring Lake Blvd., Ann Arbor, MI 48108-9657, USA; Tel: (734) 936-3352; Fax: (734) 763-2282; E-mail: jfmsj@umich.edu.

Office of Publication

Cambridge University Press, 1 Liberty Plaza, New York, NY 10006, USA; Tel: (212) 337-5000; Fax: (212) 337-5959.

Advertising Sales & Production

Kelly Miller, M.J. Mrvica Associates, Inc., 2 West Taunton Avenue, Berlin, NJ 08009, USA; Tel: (856) 768-9360; Fax: (856) 753-0064.

small but powerful

the blue pco.panda with latest sCMOS technology

ultra compact design

resolution 2048 x 2048 pixels

16-bit dynamic range

USB 3.1 interface
Single Particle Analysis

A workflow that is pushing the boundaries of modern science

Cryo-EM structure of F-actin decorated with tropomyosin at 3.7Å resolution. Courtesy of Max Planck Institute of Molecular Physiology, Dortmund, Germany.

Find out more at thermofisher.com/FEI
REVIEW ARTICLES

The Conjunctiva-Associated Lymphoid Tissue in Chronic Ocular Surface Diseases
Rodolfo Mastropasqua, Luca Agrifili, Vincenzo Fasanella, Mario Nobile, Agbeanda A. Gnama, Gennaro Falconio, Paolo Perri, Silvio Di Staso, and Cesare Mariotti

MATERIALS SCIENCE APPLICATIONS

Sriram Vijayan, Joerg R. Jinschek, Stephan Kujawa, Jens Greiser, and Mark Aindow

Atomic Scale Structural Characterization of Epitaxial (Cd,Cr)Te Magnetic Semiconductor
Bastien Bonef, Hervé Bokari, Adeline Grenier, Isabelle Moutou, Pierre-Henri Jouneau, Hidekazu Kinjo, and Shinji Kuroda

Precipitation of (Si_{2-x}Al_x)Hf in an Al-Si-Mg-Hf Alloy
Xueli Wang, Zhiqiang Xie, Huiyan Huang, Zhihong Jia, Guang Yang, Lin Gu, and Qing Liu

Reconstruction of Laser-Induced Surface Topography from Electron Backscatter Diffraction Patterns
Patrick G. Callahan, McLean P. Echlin, Tresa M. Pollock, and Marc De Graef

Practical Aspects of Electrochemical Corrosion Measurements During In Situ Analytical Transmission Electron Microscopy (TEM) of Austenitic Stainless Steel in Aqueous Media
Sibylle Schilling, Arne Janssen, Nestor J. Zaluzec, and M. Grace Burke

INSTRUMENTATION AND SOFTWARE

Nitrogen Gas Field Ion Source (GFIS) Focused Ion Beam (FIB) Secondary Electron Imaging: A First Look
Marek E. Schmidt, Anto Yasaka, Masashi Akabori, and Hiroshi Mizuta

A Comprehensive Approach Towards Optimizing the Xenon Plasma Focused Ion Beam Instrument for Semiconductor Failure Analysis Applications
Srinivas Subramaniam, Jennifer Huening, John Richards, and Kevin Johnson

A Small Spot, Inert Gas, Ion Milling Process as a Complementary Technique to Focused Ion Beam Specimen Preparation
Paul E. Fischione, Robert E.A. Williams, Arda Genc, Hamish L. Fraser, Rafal E. Dunin-Borkowski, Martina Luysberg, Cecile S. Bonifacio, and András Kovács

Simplifying Electron Beam Channeling in Scanning Transmission Electron Microscopy (STEM)
Ryan J. Wu, Anudha Mittal, Michael L. Odlyzko, and K. Andre Mkhoyan

Microscopy and Microanalysis website: http://www.journals.cambridge.org/MAM
Indexed in Chemical Abstracts, Current Contents, BIOSIS, and MEDLINE (PubMed)
Whether you are researching new materials or discovering new phenomenon in the electron microscope, nothing should delay your experiment. That's why our service team is always ready to help you with topics ranging from product installation and training to troubleshooting and upgrades. And if you need help with an experiment, we have an applications team with decades of in situ experience ready to answer your most challenging questions. We provide all of this for you, because our goal is to accelerate your in situ research.

Discover more at:

www.protochips.com/contact
QUANTAX EBSD - Featuring
OPTIMUS™ TKD, ARGUS™, ESPRIT QUBE and PicoIndenters®

Unique Solutions for EBSD and TKD

- Fastest simultaneous EBSD/EDS analysis
- OPTIMUS™ - EBSD and TKD with one detector
- Unique ARGUS™ FSE/BSE imaging system
- ESPRIT QUBE for advanced 3D analysis of EBSD/EDS data
- NEW Quantitative in-situ nanomechanical testing with Hysitron SEM PicoIndenters®

www.bruker.com/quantax-ebsd

Innovation with Integrity