

Volume 24, Number 2 April 2018

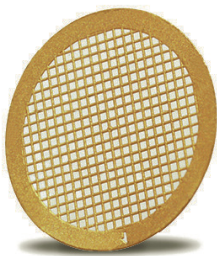
Microscopy AND Microanalysis



CAMBRIDGE
UNIVERSITY PRESS

ISSN 1431-9276

The C-flat™ Advantage



C-flat™ leads to better data sets.

Made with patent pending technology, C-flat™ provides an ultra-flat surface that results in better particle dispersion and more uniform ice thickness. Patterning is done using deep-UV projection lithography, ensuring the most accurate and consistent hole shapes and sizes down to submicron features. The precise methods by which C-flat™ is manufactured eliminate artifacts such as excess carbon and edges around holes.

C-flat™ is affordable

C-flat™ is available in 25, 50, and 100 packs at a per-grid price less than competing products.

Applications

C-flat holey carbon grids provide the ideal specimen support to achieve high resolution data in cryoTEM making C-flat the perfect choice for:

- Single particle analysis
- Cryo electron tomography
- Automated TEM analysis

...EMS has it!

CONTACT US FOR MORE INFORMATION...

Electron Microscopy Sciences

P.O. Box 550 • 1560 Industry Rd.
Hatfield, Pa 19440
Tel: (215) 412-8400 • Fax: (215) 412-8450
email: sgkcck@aol.com
or stacie@ems-secure.com

OUR MAIN INTERACTIVE WEBSITE:
www.emsdiasum.com

 **TO REQUEST A COPY
OF OUR CATALOG:**
[www.emsdiasum.com/
requests/catalog](http://www.emsdiasum.com/requests/catalog)

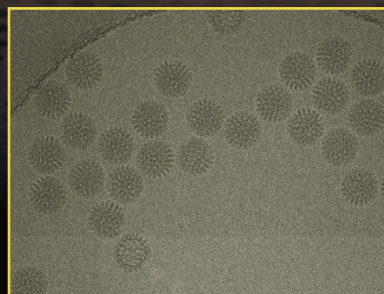
 **TO VIEW OUR
DIGITAL CATALOG:**
catalog.emsdiasum.com

the premier holey carbon grid for
cryo-transmission electron microscopy

C-FLAT™

Holey Carbon and Gold Grids for Cryo-TEM

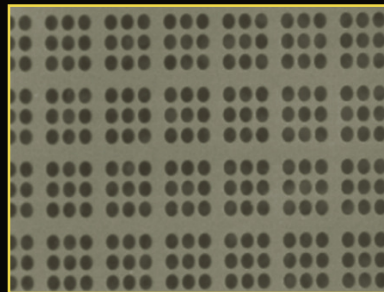
C-Flat™ is a clean, ultra-flat holey carbon film TEM grid primarily used for Cryo TEM and Automated TEM. With a variety of available hole diameters, mesh size, film thicknesses, and mesh material, there is a C-Flat™ product suitable for any application in the TEM.



Frozen-hydrated Bacteriophage Capsid
(data acquired on CF-1.2/1.4-4C).

Consistent

Researchers around the world have reported that the ultra-flat surface of C-flat™ leads to even ice thickness and uniform particle distribution, allowing for superior 3-D reconstructions. 2 µm hole sizes are standard, but various hole sizes are available to accommodate different particle sizes and magnifications.



Compatible

C-flat™ provides a regular array of analysis sites compatible with automated data collection software such as Legikon. This compatibility, in combination with the more uniform ice thickness and particle distribution reported by numerous researchers, results in more high-quality target sites per grid.



Clean

C-Flat™ uses no plastics or polymers in its production. This means C-Flat™ is shipped clean, so it's ready to use out of the box and requires no solvent washing steps prior to use, leading to less breakage of the holey carbon film.

Expanded Product Line

The breadth of applications in cryoTEM necessitate a wide range of holey carbon film patterns. And now, with the recent expansion of the product line, a C-flat™ holey carbon film is available for almost any application. Whether 600nm holes are needed for very high magnifications with ultra-high resolution cameras or large open areas are needed for larger specimens, C-flat™ is the perfect holey carbon grid.

Microscopy AND Microanalysis

An International Journal for the Biological and Physical Sciences

THE OFFICIAL JOURNAL OF

MICROSCOPY SOCIETY OF AMERICA
MICROANALYSIS SOCIETY
MICROSCOPICAL SOCIETY OF CANADA /
SOCIÉTÉ DE MICROSCOPIE DU CANADA
MEXICAN MICROSCOPY SOCIETY
BRAZILIAN SOCIETY FOR MICROSCOPY AND MICROANALYSIS
VENEZUELAN SOCIETY OF ELECTRON MICROSCOPY
EUROPEAN MICROBEAM ANALYSIS SOCIETY
AUSTRALIAN MICROSCOPY AND MICROANALYSIS SOCIETY
PORTUGUESE SOCIETY FOR MICROSCOPY

PUBLISHED IN AFFILIATION WITH

ROYAL MICROSCOPICAL SOCIETY
GERMAN SOCIETY FOR ELECTRON MICROSCOPY
BELGIAN SOCIETY FOR MICROSCOPY
MICROSCOPY SOCIETY OF SOUTHERN AFRICA

Editor-in-Chief

John Mansfield
4304 Spring Lake Blvd.
Ann Arbor, MI 48108-9657
e-mail: thejfmjfm@me.com

Administrative Editor

John Shields
University of Georgia
Athens, GA 30602
e-mail: jpshield@uga.edu

Biological Sciences Applications Editors

W. Gray (Jay) Jerome
Department of Pathology, Microbiology and
Immunology
U-2206 MCN
Nashville, TN 37232-2561
e-mail: jay.jerome@vanderbilt.edu

Heide Schatten
Department of Veterinary Pathobiology
University of Missouri-Columbia
Columbia, MO 65211
e-mail: SchattenH@missouri.edu

Rosemary White
CSIRO Plant Industry
Canberra, ACT 2601, Australia
e-mail: Rosemary.white@csiro.au

Elizabeth Wright
Department of Pediatrics
School of Medicine
Emory University
Atlanta, GA 30322
e-mail: erwright@emory.edu

Cultural Heritage Applications Editor

Edward P. Vicenzi
Smithsonian Institution, Museum
Conservation Institute
4210 Silver Hill Rd., Suitland, MD 20746
e-mail: VicenziE@si.edu

Materials Sciences Applications Editors

Vinayak Dravid
Materials Science and Engineering
Northwestern University
Evanston, IL 60208-3105
e-mail: v-dravid@northwestern.edu

Georg E. Fantner
Interfaculty Institute for Bioengineering
École Polytechnique Fédéral de Lausanne
Lausanne 1015, Switzerland
e-mail: georg.fantner@epfl.ch

David J. Larson
CAMECA
5500 Nobel Drive
Madison, WI 53711
e-mail: david.larson@ametec.com

Ian MacLaren
Materials and Condensed Matter Physics
School of Physics and Astronomy
University of Glasgow
Glasgow G12 8QQ, UK
e-mail: Ian.MacLaren@glasgow.ac.uk

Ross Marceau
Institute for Frontier Materials
Deakin University
Geelong, VIC 3216, Australia
e-mail: r.marceau@deakin.edu.au

Joseph Michael
Sandia National Laboratories
P.O. Box 5800, Albuquerque, NM 87185
e-mail: jrmicha@sandia.gov

Yoosuf N. Picard
Materials Science & Engineering
Carnegie Mellon University
Pittsburgh, PA 15213
e-mail: ypicard@cmu.edu

Masashi Watanabe
Dept. of Mater. Sci. & Eng.
Lehigh University, Bethlehem, PA 18015
e-mail: masashi.watanabe@lehigh.edu

Special Issues and Reviews Editor

David J. Smith
Department of Physics
Arizona State University, Tempe, AZ 85287-1504
e-mail: david.smith@asu.edu

Book Review Editor

Cynthia Goldsmith
Centers for Disease Control, Atlanta, GA 30333
e-mail: csg1@cdc.gov

M&M Program Guide Editor

Richard L. Martens
1013 Bevell Building
Box 870164, Tuscaloosa, AL 35487-0164
e-mail: rmartens@caf.ua.edu

Proceedings Editor

Gail Celio
University of Minnesota, St. Paul, MN 55108
e-mail: celio001@umn.edu

Editorial Board

Ralph Albrecht	<i>University of Wisconsin, Madison, Wisconsin</i>
Ilke Arslan	<i>Pacific Northwest Laboratory, Richland, Washington</i>
Mary Grace Burke	<i>University of Manchester, Manchester, UK</i>
Barry Carter	<i>University of Connecticut, Storrs, Connecticut</i>
Wah Chiu	<i>Baylor College of Medicine, Houston, Texas</i>
Marc De Graef	<i>Carnegie Mellon University, Pittsburgh, Pennsylvania</i>
Niels de Jonge	<i>INM Institute for New Materials, Saarbrücken, Germany</i>
Elizabeth Dickey	<i>North Carolina State University, Raleigh</i>
Mark Ellisman	<i>University of California at San Diego, San Diego, California</i>
Pratibha Gai	<i>University of York, United Kingdom</i>
Marija Gajdardziska-Josifovska	<i>University of Wisconsin-Milwaukee, Milwaukee, Wisconsin</i>
Paul Kotula	<i>Sandia National Labs, Albuquerque, New Mexico</i>
William Landis	<i>University of Akron, Akron, Ohio</i>
Charles Lyman	<i>Lehigh University, Bethlehem, Pennsylvania</i>
Dale Newbury	<i>National Institute of Standards and Technology, Gaithersburg, Maryland</i>
Robert Price	<i>University of South Carolina, Columbia, South Carolina</i>
Jean-Paul Revel	<i>California Institute of Technology, Pasadena, California</i>
David Smith	<i>Arizona State University, Tempe, Arizona</i>
Nan Yao	<i>Princeton University, Princeton, New Jersey</i>
Nestor Zaluzec	<i>Argonne National Laboratory, Argonne, Illinois</i>

Editorial Board Representatives from Affiliated Societies

Masashi Watanabe	<i>Lehigh University (MAS)</i>
Gautam Kumar Dey	<i>Bhabha Atomic Research Centre (EMSI)</i>
Gema Gonzalez	<i>Venezuelan Institute for Scientific Investigation (Venezuela)</i>
Michael Robertson	<i>Acadia University, Wolfville, Nova Scotia (Canada)</i>
Brendan Griffin	<i>University of Western Australia (AMMS)</i>
Guillermo Solorzano	<i>Pontificia Universidade Catolica, Rio de Janeiro (Brazil)</i>
Mike Matthews	<i>Atomic Weapons Establishment, Reading, Great Britain (EMAS)</i>
Miguel Yacaman	<i>Mexico Institute for Nuclear Research (Mexico)</i>
Henrique Almeida	<i>Universidade do Porto (Portugal)</i>

Founding Editor

Jean-Paul Revel	<i>California Institute of Technology, Pasadena, California</i>
-----------------	---

Previous Editors-in-Chief

Dale Johnson	<i>University of South Florida, Tampa, Florida</i>
Charles Lyman	<i>Lehigh University, Bethlehem, Pennsylvania</i>
Robert L. Price	<i>University of South Carolina, Columbia, South Carolina</i>

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."

Combining data quality with intuitive operation.

ZEISS EVO



// RELIABILITY
MADE BY ZEISS

Your modular SEM platform for routine investigations and research applications

The instruments of the EVO family combine high performance scanning electron microscopy with an intuitive, user-friendly experience that appeals to both trained microscopists and new users. With its comprehensive range of available options, EVO can be tailored precisely to your requirements, whether you are in life sciences, material sciences, or routine industrial quality assurance and failure analysis.

www.zeiss.com/evo



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."

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 automatic 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 the findings, data, conclusions, recommendations, procedures, results, or 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

Aims and Scope

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: associationmanagement@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 \$2364.00 in the USA, Canada, and Mexico; UK £1422.00 + VAT elsewhere. Institutions online only: US \$1533.00 in the USA, Canada, and Mexico; UK £928.00 + VAT elsewhere. Individuals print plus online: US \$691.00 in the USA, Canada, and Mexico; UK £420.00 + 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 326070. 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) 994-3096; Fax: (734) 763-2282; E-mail: thejfmjfm@me.com.

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.

© 2018 by Microscopy Society of America. Printed in the United States on acid-free paper. Periodicals postage paid at New York, NY, and additional mailing offices. Return postage guaranteed. Postmaster: Send address changes in the U.S.A. and Canada to *Microscopy and Microanalysis*, Subscription Department, Cambridge University Press, 1 Liberty Plaza, New York, NY 10006.



AMC Series Contoured Platforms



AMB Series Passive Air Isolation Platforms



NEW
AM-DVIA Electronic Platforms



AMD Series Workstations

creating the best environment for your lab equipment...

WITH HIGH PERFORMANCE ANTI-VIBRATION PLATFORMS AND WORKSTATIONS

Electron Microscopy Sciences

P.O. Box 550 • 1560 Industry Rd.
Hatfield, Pa 19440
Tel: (215) 412-8400 • Fax: (215) 412-8450
email: sgkck@aol.com
or stacie@ems-secure.com

OUR MAIN INTERACTIVE WEBSITE:
www.emsdiasum.com

 **TO REQUEST A COPY
OF OUR CATALOG:**
[www.emsdiasum.com/
requests/catalog](http://www.emsdiasum.com/requests/catalog)

 **TO VIEW OUR
DIGITAL CATALOG:**
catalog.emsdiasum.com

 **...OR SCAN HERE:**



Our state-of-the art workstations and platforms are the result of many years of development. They provide the user with a truly vibration-free surface on which to place equipment. Our products are available in a wide range of sizes and shapes to support instruments of varying weights and footprints.

- 2Hz natural frequency built-in air isolators
- Active self leveling and passive pump up versions
- Highly rigid laminated construction with damping core
- Low cost, easy to install and free from maintenance
- Ideal for laboratories and clean rooms, will meet Class 10 (Class 1 available)
- Simple, compact, easy to use and clean

a wide range of styles, sizes, options and accessories...

- ACTIVE PLATFORMS
- PASSIVE PLATFORMS
- ELECTRONIC PLATFORMS
- SORBOTHANE ISOLATION PLATFORMS
- CONTOURED PLATFORMS
- BALANCE TABLES
- HIGH LOAD WORKSTATIONS
- SIDE TABLES
- ACOUSTIC HOODS
- SAFETY CABINETS

a better working environment

Workstations provide a tailored working environment as well as featuring an isolation platform built into the work surface, making working with a microscope both faster and easier, leading to more reliable measurements in your laboratory. Platforms can also be used stand alone beneath microscopes to isolate them from external disturbances and speed up measurement.



flexible solutions

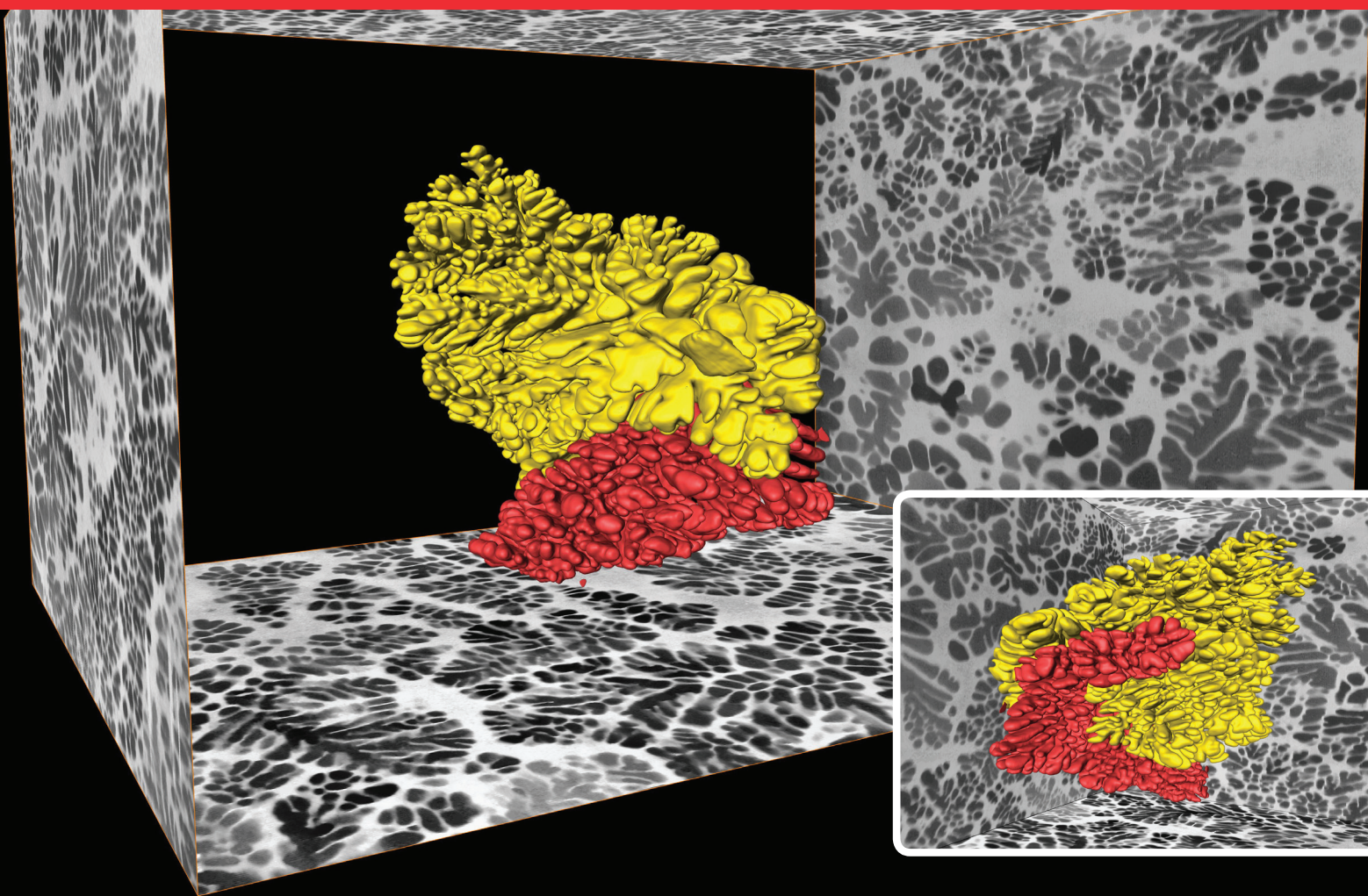
We offer a range of workstations and platforms to suit different environments and microscope performance levels. Workstations feature a platform mounted on a study steel frame with height adjustable leveling feet and guards to protect the table from accidental knocks during use.



ergonomic design

The ergonomic workstation design minimizes user stress. With the active area option microscope platforms sit flush with the work surface and the surrounding area is useable for general work. Frames have height adjustable leveling feet, for stability and user comfort with retractable castor feet, frame shelf and monitor support optional.





Thermo Scientific™ Avizo™ 3D visualization of two large adjacent crystalline dendrites of a bulk-metallic-glass matrix composite ($Zr_{58.5}Ti_{14.3}Nb_{5.2}Cu_{6.1}Ni_{4.9}Be_{11.0}$). Data was obtained by large volume serial sectioning tomography using the Thermo Scientific™ Helios™ PFIB DualBeam™ microscope. The sectioned block is about $90 \times 80 \times 70 \mu m^3$. Sample from The University of Tennessee, USA. Images courtesy of The University of Manchester.

Large 3D volumes with unprecedented surface resolution

Until recently, available technologies have limited the volumes and depths of materials that can be analyzed at high resolution, ultimately restricting the insight into structural, crystallographic, and chemical properties. This is no longer the case. The Thermo Scientific Helios PFIB DualBeam microscope offers unrivaled access to regions of interest deep below the surface—combining serial section tomography with statistically relevant data analysis.

thermofisher.com/EM-materials-science

ThermoFisher
SCIENTIFIC

Microscopy AND Microanalysis

An International Journal for the Biological and Physical Sciences

Volume 24, Number 2

April 2018

MATERIALS SCIENCE APPLICATIONS

The Accuracy of Al and Cu Film Thickness Determinations and the Implications for Electron Probe Microanalysis

Mike B. Matthews, Stuart L. Kearns, and Ben Buse

83

Nano-Cathodoluminescence Measurement of Asymmetric Carrier Trapping and Radiative Recombination in GaN and InGaN Quantum Disks

Julia I. Deitz, A. T. M. Golam Sarwar, Santino D. Carnevale, Tyler J. Grassman, Roberto C. Myers, and David W. McComb

93

On the Progress of Scanning Transmission Electron Microscopy (STEM) Imaging in a Scanning Electron Microscope

Cheng Sun, Erich Müller, Matthias Meffert, and Dagmar Gerthsen

99

In Situ Scanning Electron Microscope (SEM) Observations of Damage and Crack Growth of Shale

Zhendong Cui and Weige Han

107

SOFTWARE AND INSTRUMENTATION

Evaluating X-Ray Microanalysis Phase Maps Using Principal Component Analysis

Ben Buse and Stuart Kearns

116

On the Origin of Extended Resolution in Kelvin Probe Force Microscopy with a Worn Tip Apex

Sergey Y. Luchkin and Keith J. Stevenson

126

BIOLOGICAL SCIENCE APPLICATIONS

The Effects of Betaine on the Nuclear Fractal Dimension, Chromatin Texture, and Proliferative Activity in Hepatocytes in Mouse Model of Nonalcoholic Fatty Liver Disease

Milena Vesković, Milica Labudović-Borović, Ivan Zaletel, Jelena Rakočević, Dušan Mladenović, Bojan Jorgačević, Danijela Vučević, and Tatjana Radosavljević

132

The Calamistrum of the Feather-Legged Spider *Uloborus plumipes* Investigated by Focused Ion Beam and Scanning Electron Microscopy (FIB-SEM) Tomography

Alexander Heiss, Daesung Park, and Anna-Christin Joel

139

Cultured Human Retinal Pigment Epithelial (hRPE) Sheets: A Search for Suitable Storage Conditions

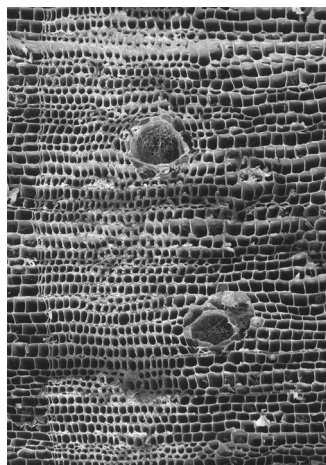
Ayyad Z. Khan, Tor P. Utheim, Sjur Reppe, Leiv Sandvik, Torstein Lyberg, Borghild B.-H. Roald, Ibrahim B. Ibrahim, and Jon R. Eidet

147

Scanning Electron Microscopy (SEM) Energy Dispersive X-ray Spectroscopy (EDS) Mapping and *In-situ* Observation of Carbonization of Culms of *Bambusa Multiplex*

Visittapong Yordsri, Chanchana Thanachayanont, Shunsuke Asahina, Yuuki Yamaguchi, Masahiro Kawasaki, Tetsuo Oikawa, Tadashi Nobuchi, and Makoto Shiojiri

156



On the Cover: Variable pressure scanning electron microscope image of a transversal section of *Pinus sylvestris* after attack by fungus *Coniophora puteana*, showing abundant hyphae in the resin canals and alteration of axial tracheid walls in both latewood and earlywood. Image © The Trustees of the British Museum.

Microscopy and Microanalysis website: <http://www.cambridge.org/MAM>

Indexed in Chemical Abstracts, Current Contents, BIOSIS, and MEDLINE (PubMed)

Distinguishing the Signs of Fungal and Burial-Induced Degradation in Waterlogged Wood from Biskupin (Poland) by Scanning Electron Microscopy

Diego Tamburini, Caroline R. Cartwright, Grzegorz Cofa, Magdalena Zborowska, and Miroslava Mamoňová

163

MICROGRAPHIA

Ultrastructural Alterations of Midgut Epithelium, But Not Greater Wing Fluctuating Asymmetry, in Paper Wasps (*Polistes dominula*) from Urban Environments

Carlo Polidori, Agustín Pastor, Alberto Jorge, and José Pertusa

183

See you in Sydney this September!



19TH INTERNATIONAL
MICROSCOPY CONGRESS

IMC19

9-14 September 2018

International Convention Centre, Sydney



ARGYLE DIAMOND
PARTNER
ThermoFisher
SCIENTIFIC

OPAL
PARTNERS
JEOL
Innovation in resolution

GOLD
PARTNERS
ZEISS
GATAN
HITACHI
Inspire the Next

BRONZE PARTNERS
BRUKER
OXFORD
INSTRUMENTS
The Business of Science
NanoMEGAS
Advanced Tools for electron diffraction

MEDIA
PARTNERS
MICROSCOPY
ANALYSIS
Microscopy
TODAY

OFFICIAL CONGRESS
SPONSOR AIRLINE
QANTAS
Spirit of Australia

Meet our world renowned
PLENARY SPEAKERS



PROFESSOR DAN SHECHTMAN

Nobel Prize Winner,
Technion - Israel Institute
of Technology



A/PROFESSOR JENNIFER DIONNE

Stanford University,
USA



PROFESSOR ZHIWEI SHAN

Xi'an Jiaotong University
(XJTU), China



DR MISTY JENKINS

Walter Eliza Hall
Institute for Medical
Research, Australia

IFSM SYMPOSIUM 14 September 2018

The ISFM Symposium will be a Congress highlight that brings our community together to celebrate the pinnacles of achievement in the field. We will be joined by Nobel Prize winner and joint winner of the Eduard Kellenberger Medal, **Professor Joachim Frank**. See the full list of speakers on our website.



Visit imc19.com/ifsm-symposium/ to read more.

INVITED SPEAKERS Line up Announced!

IMC19 will bring together experts and emerging leaders in Microscopy, who will together create a truly groundbreaking and transformational Scientific Program. With this, we are very pleased to introduce the Invited Speakers for the Congress. Visit imc19.com/pleenary-and-invited-speakers/ to read more about who will be joining us.

DISCOUNTED FLIGHTS for IMC19 Delegates

Qantas is delighted to be the major airline sponsor for IMC19. Qantas, in conjunction with our partner airlines, are offering registered delegates and travel partner's special discounted airfares which are easily booked online at imc19.com.

IMC19 SPONSORS & EXHIBITORS

Position your brand at the event where the global leaders in microscopy meet. For enquiries, contact Drew Whait for more information.

Email: sponsorship@arinex.com.au

Phone: +61 2 9265 0700



@IMCnews



imc19_sydney



@IMC19Sydney

CONGRESS HOSTS



CONGRESS MANAGERS



Arinex Pty Ltd: Lvl 10, 51 Druitt St, Sydney, NSW 2000
Phone: +61 2 9265 0700
Email: imc19@arinex.com.au

VISIT

imc19.com

FOR MORE INFORMATION



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 (Si_3N_4) window
- Vacuum encapsulated module
- Highest throughput SDD available, with unparalleled resolution
- Safe for plasma cleaning

AMETEK[®]

MATERIALS ANALYSIS DIVISION

<https://doi.org/10.1017/S1431927618000235> Published online by Cambridge University Press

edax.com

EDAX[®]
Smart Insight