# Program

**Wednesday, 13th February 2019**

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<tr>
<th>Time</th>
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<tr>
<td>8:00</td>
<td>Registration opens, The Brighton Savoy</td>
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<td>8:50</td>
<td>Welcome address and opening</td>
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<td><strong>Session 1: Soft X-ray emission spectroscopy, 9:00-10:30</strong> Chair: Raynald Gauvin</td>
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<td>9:00</td>
<td>Soft X-ray emission spectroscopy for chemical state analysis</td>
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<td><strong>Masami Terauchi</strong>¹, <strong>Yohei Sato</strong>¹</td>
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<td>1. Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Sendai, Japan</td>
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<tr>
<td>9:30</td>
<td>Fast Soft X-Ray Mapping</td>
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<td><strong>Nick Wilson</strong>¹, <strong>Aaron Torpy</strong>¹ and <strong>Colin MacRae</strong>¹</td>
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<td>1. CSIRO Mineral Resources, Microbeam Laboratory, Private Bag 10, Clayton South, 3169, Australia</td>
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<tr>
<td>9:50</td>
<td>Carbon K line spectrum investigation of polymers using Soft X-ray Emission Spectrometer equipped to EPMA</td>
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<td><strong>Masaru Takakura</strong>¹, <strong>Takanori Murano</strong>¹, <strong>Shogo Koshiya</strong>¹, and <strong>Hideyuki Takahashi</strong>¹</td>
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<td>1. SA Business Unit JEOL Ltd. 3-1-2 Musashino, Akishima, Tokyo 196-8558, Japan</td>
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<tr>
<td>10:10</td>
<td>Soft X-Ray and CL mapping of minerals</td>
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<td><strong>Colin M. MacRae</strong>¹, <strong>M.A. Pearce</strong>, <strong>N.C. Wilson</strong>, <strong>A. Torpy</strong> and <strong>M.A. Glenn</strong></td>
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<tr>
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<td>1. CSIRO Mineral Resources, Microbeam Laboratory, Private Bag 10, Clayton South, 3169, Australia</td>
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<tr>
<td>10:30</td>
<td>Morning tea</td>
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</table>
Session 2: Electron backscatter diffraction, 11:00-12:20  
Chair: Mike Matthews

Phase heritage: deciphering evidence of pre-existing phases via inherited crystallographic orientations
Nicholas E. Timms1, Mark A. Pearce2, Timmons M Erickson1,3, Aaron J. Cavosie1, Cyril Cayron4, Steven M. Reddy1, and Michael R. Zanetti5
1. School of Earth and Planetary Sciences, Curtin University, Perth, Western Australia
2. CSIRO Mineral Resources, Kensington, Western Australia
3. JETS, ARES division, NASA JSC, Houston, TX 77058, USA
4. Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland
5. University of Western Ontario, Ontario, Canada

Finding the known unknowns: Quantitatively combining multiple microanalytical approaches through machine learning.
Joshua F. Einsle1, Ben Martineau2, Iris Buisman3, Zoja Vukmanovic3, Duncan Johnstone2, Alex Eggeman4 and Paul A. Midgley2, Richard J. Harrison3
1. Department of Earth Science and Engineering, Imperial College London, London, UK
2. Department of Materials Science and Metallurgy, University of Cambridge, Cambridge, UK
3. Department of Earth Sciences, University of Cambridge, Cambridge, UK
4. CEA-LETI, Grenoble, France
5. School of Materials, University of Manchester, Manchester, UK

Combining Electron microprobe, EBSD and SXES in the study of the composition and microstructure of modern Aluminium Alloys
Anthony (Tony). E. Hughes1,2, A.M. Glenn1, N.C. Wilson1, A. Torpy1, C.M. MacRae1, M.A. Gibson3,4
1. CSIRO, Mineral Resources, Bayview Ave, Clayton, 3169 Australia
2. Institute of Frontier Materials, Deakin University, 221 Bunwood Highway, Bunwood VIC 3125 Australia
3. Department of Materials Science and Engineering, Monash University, Clayton, 3800 Australia
4. CSIRO, Manufacturing, Bayview Ave, Clayton, 3169 Australia

An EBSD Investigation of Sphalerite Grain Growth in a “Black Smoker,” Hydrothermal Vent from a Sea Floor VMS Deposit.
A. Matthew. Glenn1, S. Hu1, S. Barnes1, C. M. MacRae1, A. Torpy1, J. Parr1, R. Binns1.
1. CSIRO Mineral Resources, Microbeam Laboratory, Private Bag 10, Clayton South, 3169, Australia

Session 3: Outreach, 12:20-12:30

Inspire STEM education
Jessica Jones1 and Graeme Jones2
1. Inspire STEM Education, 330 Glen Osmond Rd, Myrtle Bank, SA 5064
   Email outreach@newspec.com.au, phone 08 8463 1976
   Facebook: Inspire STEM Education Australia
2. NewSpec Pty Ltd, Myrtle Bank, SA

Lunch

AMAS Annual General Meeting
Session 4: Cathodoluminescence, 13:40-15:30

Chair: Nestor Zaluzec

13:40
SEM-based cathodoluminescence imaging for understanding cementation in mudrocks
Kitty L. Milliken¹
1. Bureau of Economic Geology, University of Texas at Austin, Austin, Texas, USA

14:10
Cathodoluminescence of Inorganic Semiconductors: Challenges and Strategies
Mark Lockrey¹, Hemant Mulmudi², The Duong²
1. Microstructural Analysis Unit, University of Technology Sydney, Sydney, Australia
2. College of Engineering and Computer Science, Australian National University, Canberra, Australia

14:30
Observation of bright and dark modes in plasmonic trimers using cathodoluminescence in a scanning electron microscope.
Amelia C. Y. Liu¹,², D. E. Gómez³, J. Etheridge¹, ⁴ and T. Coenen⁵
1. Monash Centre for Electron Microscopy, Monash University, Clayton, Australia
2. School of Physics and Astronomy, Monash University, Clayton, Australia
3. School of Applied Science, RMIT University, Melbourne VIC 3000, Australia
4. School of Materials Science and Engineering, Monash University, Clayton, Australia
5. DELMIC BV, Kanaalweg 4, 2628 EB Delft, The Netherlands

14:50
Barite cathodoluminescence as a potential indicator of undiscovered ore deposits
Heather Lowers¹, Danielle Olinger¹ and David Adams¹
1. U.S. Geological Survey, Geology, Geophysics, and Geochemistry Science Center, Denver, CO USA

15:10
Zoning in cassiterite: Sectors or twins?
Kristian Drivenes¹, Bjørn Eske Sørensen¹, Sytle Antao² William Brownscombe³, Chris Debuhr², Morten Peder Raanes⁴, Reimar Seltmann³, and John Spratt³.
1. Norwegian University of Science and Technology, Department of Geoscience and Petroleum, Trondheim, Norway
2. University of Calgary, Department of Geoscience, Calgary, Canada
3. Natural History Museum, London, United Kingdom
4. Norwegian University of Science and Technology, Department of Material Science and Technology, Norway

15:30
Afternoon tea
Developments in angle- and time-resolved cathodoluminescence imaging.

Sangeetha Hari¹ and T. Coenen¹
1. DELMIC BV, Kanaalweg 4, 2628 EB Delft, The Netherlands

Innovation in elemental imaging using Laser-Induced Breakdown Spectroscopy (LIBS)

F.R. Doucet¹, L.Ç. Özcan¹, K. Rifai¹,², F. Vidal²
1. ELEMISSION inc., 3410, Thimens Blvd., Montréal, QC, CANADA, H4R 1V6
2. INRS University, Dept. of Plasma diagnostics, Varennes, QC, CANADA, J3X 1S2

Quantification of structural radiation damage in ceramic waste-form materials using luminescence spectroscopy of REE³

Christoph Lenz¹,²,³, Gordon Thorogood¹, Robert Aughterson¹, Mihail Ionescu¹, Daniel Gregg¹, Joel Davis¹, Greg Lumpkin¹, Colin MacRae³
1. Australian Nuclear Science and Technology Organisation (ANSTO), Lucas Heights, NSW 2234, Sydney, Australia; *email: christoph.lenz@univie.ac.at
2. Institut für Mineralogie & Kristallographie, University of Vienna, 1090 Vienna, Austria
3. Microbeam laboratory, CSIRO, Clayton, VIC 3168, Melbourne, Australia

Ultrafast analysis in the mining industry

L.Ç. Özcan¹, F.R. Doucet¹, K. Rifai¹,², F. Vidal²
1. ELEMISSION inc., 3410, Thimens Blvd., Montréal, QC, CANADA, H4R 1V6
2. INRS University, Dept. of Plasma diagnostics, Varennes, QC, CANADA, J3X 1S2

AXT Symposium Dinner
### Thursday, 14th February 2019

**Session 6: Meteorites, 8:30-10:30**  
Chair: Richard Wuhrer

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<th>Authors</th>
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<tr>
<td><strong>8:30</strong></td>
<td>Aberration-corrected STEM of cosmic nanodiamonds and synthetic analogs</td>
<td>Rhonda M. Stroud¹ and Bradley De Gregorio¹</td>
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<tr>
<td>¹. Materials Science and Technology Division, US Naval Research Laboratory, 4555 Overlook Ave. SW, Washington, DC 20375, USA.</td>
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<tr>
<td><strong>9:00</strong></td>
<td>SEM-based quantitative analysis of lunar meteorite Northwest Africa 2727</td>
<td>Stephen M. Seddio¹ and Sarah N. Valencia²,³</td>
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</table>
| ¹. Thermo Fisher Scientific, Fitchburg, Wisconsin, USA  
². University of Maryland, Department of Astronomy, College Park, Maryland 20742, USA  
³. NASA Goddard Space Flight Center, Planetary Geology, Geophysics, and Geochemistry Laboratory, Greenbelt, Maryland 20771, USA |
| **9:20** | Quantitative Compositional Stage Mapping and Cluster Analysis of a Vanadian Slag Sample, and Preliminary EPMA of Lunar Basalt Meteorite NWA 12384 | Paul K. Carpenter¹ |
| ¹. Dept. of Earth and Planetary Sciences, Washington University in St. Louis, Campus Box 1169, Saint Louis, MO, 63130, USA |
| **9:50** | Discovering Rapid Classification of Meteorites Using the Micro-XRF Technique | Samuel Scheller¹, Andrew Menzies¹, Roald Tagle¹, Gustavo Miranda-Díaz²,³, Fabrizio Fuentes-Galaz², Johan Segovia-Chacoff², Wilson Godoy² |
| ¹. Bruker Nano GmbH, Product Management and Application, Berlin, Germany  
². Museo Mineralógico, Universidad de Atacama, Colipí 587, Copiapó, Chile  
³. Institut für Mineralogie, Technische Universität Bergakademie Freiberg, Akademiestraße 6, 09599, Freiberg, Alemania |
| **10:10** | Analysis of particles from the Itokawa asteroid: from the grain-scale to the atomic-scale | William D.A. Rickard¹, N.E. Timms², F. Jourdan², D.W. Saxey¹, D. Fougerouse¹,², S.M. Reddy¹,², Z. Quadir³ |
| ¹. Advanced Resource Characterisation Facility, John de Laeter Centre, Curtin University, GPO Box U1987, Perth, WA 6845, Australia  
². School of Earth and Planetary Sciences, Curtin University, GPO Box U1987, Perth, WA 6845, Australia  
³. Microscopy and Microanalysis Facility, John de Laeter Centre, Curtin University, GPO Box U1987, Perth, WA 6845, Australia |
| **10:30** | Morning tea |
Session 7: Scanning electron microscopy, 11:00-12:25  
Chair: Colin MacRae

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<th>Time</th>
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<th>Presenters</th>
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<tr>
<td>11:00</td>
<td>Analytical STEM at 30 keV</td>
<td>Raynald Gauvin¹ and Nicolas Brodusch¹</td>
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<td>¹. Department of Materials Engineering, McGill University, Montréal, Québec, Canada, H3A 0C5</td>
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<td>11:30</td>
<td>Image contrast of ultra low voltage scanning electron microscope using Auger electron spectrometer</td>
<td>Yusuke Sakuda¹², Shunsuke Asahina¹, Takanari Togashi² and Masato Kurihara²</td>
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<td>¹. JEOL Ltd., EP business unit, SEM team, Tokyo JAPAN</td>
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<td>². Yamagata University, Faculty of science, Yamagata JAPAN</td>
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<td>11:50</td>
<td>FEGSEM Dedicated X-Ray Mapping System with Multiple Silicon Drift Detectors for Quantitative X-Ray Mapping</td>
<td>Richard Wuhrer * and Ken Moran **</td>
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<td>* Western Sydney University, Advanced Materials Characterisation Facility (AMCF), Australia</td>
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<td>** Moran Scientific Pty Ltd, 4850 Oallen Ford Road, Bungonia, NSW, 2580, Australia</td>
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<td>12:10</td>
<td>Water or silica, which is more important in the plagioclase albition process?</td>
<td>Gan Duan¹, Joel Brugger¹, Barbara Etschmann¹, Rahul Ram¹, Steven Micklethwaite¹, Andrew Frierdich¹</td>
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<td>¹. School of Earth, Atmosphere and Environment, Monash University, Clayton, 3800, Victoria, Australia</td>
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<td>12:25</td>
<td>Lunch</td>
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<td>13:30</td>
<td>X-ray Microanalysis of Nanostructures and Soft Matter</td>
<td>Nestor J. Zaluzec</td>
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<td>Argonne National Laboratory, Photon Sciences Division, Argonne, IL, USA</td>
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<td>14:00</td>
<td>Advanced Electron Microscopy in Understanding Gold Nanoparticle Growth</td>
<td>Weilun Li,† Wenming Tong,† Alison M. Funston,†,§ Joanne Etheridge†,§</td>
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<td></td>
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<td>†Department of Materials Engineering, Monash University, VIC, 3800, Australia</td>
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<td>†School of Chemistry, Monash University, VIC, 3800, Australia</td>
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<td>†ARC Centre of Excellence in Exciton Science, Monash University, VIC, 3800, Australia</td>
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<td>†Monash Centre for Electron Microscopy Monash University, VIC, 3800, Australia</td>
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<td>14:15</td>
<td>Quantitative atomic scale analysis of diffusion phenomena in nitride multilayer thin films as observed by STEM</td>
<td>Magnus Garbrecht† &amp; B. Saha§</td>
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<td></td>
<td>1. Australian Centre for Microscopy &amp; Microanalysis, The University of Sydney, NSW 2006, Australia.</td>
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<td></td>
<td>2. Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Jakkur, Bangalore 560064, India.</td>
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<td>14:35</td>
<td>Melting glassy carbon at high pressures and temperatures</td>
<td>Brenton A. Cooka, T.B. Shiellb, D.R. McKenziec, M.R. Fielda, B. Haberld, A. Karandikara, R. Boehlera,b, J.E. Bradbya,b, D.G. McCullocha</td>
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<td>aSchool of Science, RMIT University, Melbourne, VIC, Australia</td>
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<td>bDepartment of Electronic Materials Engineering, Research School of Physics and Engineering, The Australian National University, Canberra, ACT, Australia</td>
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<td>cSchool of Physics, The University of Sydney, NSW, Australia</td>
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<td>daChemical and Engineering Materials Division, Oak Ridge National Laboratory, TN, USA</td>
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<td>eGeophysical Laboratory, Carnegie Institution of Washington, NW Washington, DC, USA</td>
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<td>14:50</td>
<td>Afternoon tea</td>
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Session 9: X-ray fluorescence, 15:20-16:20  Chair: Heather Lowers

15:20  Micro-Focused Five Dimensional X-ray Imaging and Analysis with the Color X-ray Camera

Jeffrey M. Davis¹, Julia Schmidt¹, Martin Huth¹, Robert Hartmann², Heike Soltau¹, Lothar Strüder²,³

1. PNDetector GmbH, Otto-Hahn-Ring 6, 81739 München, Germany
2. PNSensor GmbH, Otto-Hahn-Ring 6, 81739 München, Germany
3. University of Siegen, Walter-Flex-Strasse 3, 57072 Siegen, Germany

15:40  Advances in high throughput laboratory microXRF with high resolution and multiple x-ray energy beams for trace-level quantification

Benjamin Stripe¹, Sylvia JY Lewis¹, Wenbing Yun¹, Janos Kirz¹, Alan Lyon¹, SH Lau¹, Xiaolin Yang¹

¹. Sigray, Inc. Concord, CA USA

16:00  Deciphering recrystallization and chemical reaction mechanisms in gold deposits using macro- to micro-scale analyses

Mark A. Pearce¹, Michael F. Gazley¹,² and Martin Verco³

1. CSIRO Mineral Resources, Kensington, Western Australia
2. RSC Mining and Mineral Exploration, Wellington, New Zealand
3. Northern Star Resources, Jundee Operations, Wiluna, Western Australia

Session 10: 30th AMAS Anniversary, 16:20-17:00  Chair: Angus Netting

16:20  Large Area X-Ray Mapping: A 1980s Historical Perspective

Harry Buskes¹ and Les Moore²

¹. BHP Central Research Labs, Retired.
². BlueScope Steel.

16:45  In the Beginning - most of us had No Idea...but

Brendan J Griffin

19:00  Thermo Fisher Scientific Symposium Dinner
Friday, 15th February 2019

Session 11: Electron Probe Microanalysis, 8:30-10:20

Chair: Paul Carpenter

8:30

Electron Probe Microanalysis of U and U-alloys… How hard can it be?

Mike Matthews¹, Stuart Kearns¹ and Ben Buse¹

1 University of Bristol, School of Earth Sciences, Wills Memorial Building, Queens Road, Clifton, BS8 1RJ, UK

9:00

Comparing and combining energy and wavelength dispersive x-ray spectrometry in electron probe microanalysis of natural materials

Karsten Goemann¹

1. Central Science Laboratory, University of Tasmania, Hobart TAS 7001, Australia

9:20

Chemical and structural changes of SEM and EPMA specimen carbon coating, polymers and sulphide minerals by downstream plasma cleaning

E. Tavenner¹, Ron Rasch², B. Wood², H. Bostelmann², J. Lipton-Duffin³ and A. Jolly⁴

1. Creative Polymers Pty. Ltd., Toowoomba, Australia
2. Centre for Microscopy and Microanalysis, The University of Queensland, Brisbane, Australia
3. Central Analytical Research Facility, Queensland University of Technology, Brisbane, Australia
4. School of Agricultural, Computational and Environmental Sciences, University of Southern Queensland, Toowoomba, Australia

9:40

Combined optical microscopy and Electron Probe Microanalysis (EPMA) study to determine the source of phosphorus contamination in West-Australian Brockman high-P Iron Ores

Sarath Hapugoda¹, Mark I. Pownceby², Ying Yu³

¹ CSIRO Mineral Resources, Kenmore QLD 4069, Australia
² CSIRO Mineral Resources, Private Bag 10, Clayton South VIC 3169, Australia
³ Centre for Microscopy and Microanalysis (CMM), University of Queensland, St Lucia 4072, Australia

10:00

A multiplatform approach to unravelling geological problems: a case study from Olympic Dam

Wade, B.P.¹, Verdugo-Ihl, M.R.², Courtney-Davies, L², Ciobanu, C.L², Cook, N.², Ehrig, K.³, Slattery, A.¹, Gilbert, S.¹, Neubauer, K.¹

1. Adelaide Microscopy, University of Adelaide, Adelaide, Australia.
2. School of Chemical Engineering, University of Adelaide, Adelaide, Australia.
3. BHP Olympic Dam, Adelaide, Australia

10:20

Morning tea
Strategies for structure retrieval in STEM with segmented and pixellated detectors

Scott D. Findlay¹, L.J. Allen², H.G. Brown¹, Z. Chen¹, L. Clark¹, Y. Ikuhara³, M.J. Morgan¹, D.M. Paganin¹, T.C. Petersen¹, N. Shibata³ and M. Weyland⁴

1. School of Physics and Astronomy, Monash University, Melbourne, Australia
2. School of Physics, University of Melbourne, Melbourne, Australia
3. Institute of Engineering Innovation, University of Tokyo, Tokyo, Japan
4. Monash Centre for Electron Microscopy, Monash University, Melbourne, Australia

Aberration-corrected HR-STEM characterization of sulphosalt minerals

Ashley D Slattery¹, Wei Li²,³, Cristiana L Ciobanu³, Nigel J Cook³, Wenyuan Liu¹,⁴, Benjamin P Wade¹, Guiqing Xie²

2. Key Laboratory of Metallogeny and Mineral Assessment, Institute of Mineral Resources, Chinese Academy of Geological Sciences, Beijing, China.
3. School of Chemical Engineering, The University of Adelaide, Adelaide, SA, Australia.
4. College of Zijin Mining, Fuzhou University, Fuzhou, China.

Microstructural evidence for a shear-driven transformation to hexagonal diamond

Sherman Wong¹, T. B. Shiel¹,², B. A. Cook¹, J. E. Bradby², D. R. McKenzie³ and D. G. McCulloch¹

1. Physics, School of Science, RMIT University, Melbourne, VIC, 3001, Australia
2. Department of Electronic Materials Engineering, Research School of Physics and Engineering, The Australian National University, Canberra, ACT, 2601
3. School of Physics, The University of Sydney, NSW, 2006, Australia

Amorphous carbon-based resistive switching devices for neuromorphic applications

Thomas J. Raeber¹, A. J. Barlow², Z. C. Zhao³, D. R. McKenzie³, J. G. Partridge¹, D. G. McCulloch¹ and B. J. Murdoch¹

1. School of Science, RMIT University, VIC 3001, Melbourne, Australia
2. Centre for Materials and Surface Science (CMSS), Department of Chemistry and Physics, La Trobe University, VIC 3086, Melbourne, Australia
3. School of Physics, The University of Sydney, NSW 2006, Sydney, Australia

Phase retrieval using diffraction from straight edge apertures

Wei Chao¹, David Paganin², Changlin Zheng³, Joanne Etheridge¹,³

1. Material Science and Engineering, Monash University, Victoria 3800, Australia
2. School of Physics, Monash University, Victoria 3800, Australia
3. Monash Centre for Electron Microscopy, Monash University, Victoria 3800, Australia

Sandwich structure in Al-Cu(-Au) alloys—characterization by atomic-resolution HAADF-STEM and EDXS-STEM

Yunhe Zheng¹, Xiaojun Zhao², Shiqi Liu¹, Yixian Liu¹, Nick Wilson³, Houwen Chen², Jinfeng Li², Ziqiao Zheng⁴, Laure Bourgeois¹,⁵, Jian-Feng Nie¹

1. Department of Materials Science and Engineering, Monash University, Victoria, Australia
2. College of Materials Science and Engineering, Chongqing University, Chongqing, PR China
3. CSIRO Manufacturing, Victoria, Australia
4. School of Materials Science and Engineering, Central South University, Changsha, PR China
5. Monash Centre for Electron Microscopy, Monash University, Victoria, Australia
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Session 13: Mass Spectrometry, 13:30-14:50

Chair: Rhonda Stroud

13:30
Atomic Layer Deposited Amorphous Metal Oxide Films as a Preventive Treatment for Museum Glass
Miriam E. Hiebert¹, Raymond J. Phaneuf¹, and Edward P. Vicenzi²
1. University of Maryland, Department of Materials Science and Engineering, College Park, Maryland 20742 USA
2. Smithsonian Institution, Museum Conservation Institute, 4210 Silver Hill Rd. Suitland, Maryland 20746 USA

Isotopic imaging of minerals with NanoSIMS
Matt Kilburn¹
1. Centre for Microscopy, Characterisation and Analysis, University of Western Australia, Perth 6009, Australia

Development of accurate methods for LA-ICP-MS analysis of mineral phases using non-matrix matched reference materials
Leonid Danyushevsky¹,², Jay Thompson¹ and C. Ashley Norris³
1. CODES, University of Tasmania, Hobart, Tasmania, Australia
2. TMVC, University of Tasmania, Hobart, Tasmania, Australia
3. Norris Software, Molesworth, Tasmania, Australia

14:10
Deciphering the complex mineralogy of heavy mineral river sand deposits through spectral deconvolution and clustering of hyperspectral x-ray maps
Aaron Torpy¹, M. I. Pownceby¹, M. A. Rahman¹,²,³, N. A. S. Webster¹, N. C. Wilson¹, C. M. MacRae³, and M. N. Zaman³
1. CSIRO Mineral Resources, Clayton, Victoria
2. RMIT University, Melbourne, Victoria
3. Institute of Mining, Mineralogy and Metallurgy (IMMM), Bangladesh Council of Scientific and Industrial Research (BCSIR), Joypurhat, Bangladesh

14:50
Symposium close