IAMNano 2019 Düsseldorf

International Workshop on Advanced and In situ Microscopies of Functional Nanomaterials and Devices

October 27 – 30, 2019

Venue: Max-Planck-Institut für Eisenforschung,
Max-Planck-Str. 1, 40237 Düsseldorf, Germany

https://www.mpie.de/iamnano2019
Scope of the workshop

The workshop aims to provide a forum for researchers who are interested in applying advanced imaging and spectroscopy methods of electron microscopy, including aberration-corrected, \textit{in-situ}, environmental and low-voltage electron microscopy, to topical issues in materials science and engineering, in nanoscience, in soft matter research, in interface and surface science, and in biomaterials research. As these methods are of fundamental importance in virtually all technological fields, contributions are invited that address the broad spectrum of current materials research. Novel methodological developments will be discussed as well as topical areas of research on thin films, bulk materials, surfaces, materials at the nanoscale and at the interface between the physical and life sciences, for understanding structure-property relationships of materials, as well as for metrology. Selected topics will be introduced by invited keynote speakers during the plenary sessions. A poster session provides room for the presentation and discussion of current research on

- New developments in aberration-corrected transmission electron microscopy (TEM) and scanning TEM (STEM)
- Advanced spectroscopy including energy dispersive X-ray spectroscopy (EDS) and electron energy loss spectroscopy (EELS)
- Electron holography and phase retrieval
- \textit{In situ} and environmental TEM
- Computational microscopy and advanced data analysis
- Multiscale characterisation
- Materials for sustainable energy applications and mobility
- Advanced engineering materials
- Soft and biological materials

Local organizing committee
(alfabetical order)

Gerhard Dehm - MPIE Düsseldorf
Christian Liebscher - MPIE Düsseldorf
Christina Scheu - MPIE Düsseldorf / RWTH Aachen
Bernhard Völker - RWTH Aachen

Scientific Advisory Board
(alfabetical order)

Rafal Dunin-Borkowski - Ernst Ruska Center Jülich, Germany
Gunther Eggeler - Ruhr Universität Bochum, Germany
Wolfgang Jäger - CAU University of Kiel, Germany
Joachim Mayer - RWTH Aachen / FZ Jülich, Germany
Eva Olsson - Chalmers University, Sweden
Dierk Raabe - MPIE Düsseldorf, Germany
Jochen Schneider - RWTH Aachen, Germany
Robert Sinclair - Stanford University, USA

Contact information e-mail: iammnano2019@mpie.de
Preliminary Conference Program

Oct 27, 2019 SUNDAY 13.30 – 16.30 Registration

13.30 – 16.30 Registration

**14.15 – 14.30** OPENING REMARKS & WELCOME

Opening Session POTENTIALS OF ABERRATION-CORRECTED (S)TEM
Chair: Eva Olsson, Wolfgang Jäger

14.30 – 15.00 Harald Rose (TU Darmstadt, Germany)
*Minimum-dose phase-contrast tomography by successive numerical optical sectioning employing the aberration-corrected STEM and a pixelated detector*

15.00 – 15.30 Max Haider (CEOS Heidelberg, Germany)
*Advancement of high-resolution electron microscopes*

15.30 – 16.00 Ute Kaiser (Universität Ulm, Germany)
*Properties of carbon-based low-dimensional materials from low- or medium-voltage atomic-scale TEM experiments*

16.00 – 16.30 COFFEE BREAK & DISCUSSIONS

16.30 – 17.00 Kazu Suenaga (AIST Tsukuba, Japan):
*Angular-resolved EELS of low-dimensional materials by means of low-voltage TEM/STEM*

17.00 – 17.30 Joanne Etheridge (Monash University)
*Tuning STEM: Tailoring the incident and scattered wave fields for optimum specimen information*

17.30 – 18.00 Colin Ophus (Lawrence Berkeley National Laboratory, USA)
*Phase reconstruction and simulation of STEM experiments in 2D and 3D using the scattering matrix formalism*

18.00 – 18.30 Chunlin Jia (Xi’an University & FZ Jülich, China & Germany):
*Quantitative HRTEM of functional oxides using negative Cs imaging*
Session 1  ELECTRON HOLOGRAPHY, DPC, MAGNETIC STRUCTURES  
Chair: Jürgen Plitzko

09.00 - 09.30  Christoph Koch (HU Berlin, Germany)  
*Computer-assisted imaging and spectroscopy in the TEM*

09.30 - 10.00  Rafal Dunin-Borkowski (FZ Jülich, Germany)  
*Towards three-dimensional and atomic-resolution characterisation of magnetic moments in the electron microscope*

10.00 - 10.30  Jozef Zweck (University Regensburg)  
*Recent developments in imaging of magnetic and electric fields*

10.30 – 11.00  **COFFEE BREAK & DISCUSSIONS**

Session 2  IN SITU AND ENVIRONMENTAL TEM  
Chair: Gerhard Dehm

11.00 - 11.30  Sang Ho Oh (Sungkyunkwan University, South Korea)  
*In situ atomic-scale observation of polar surfaces of oxides at high temperatures*

11.30 – 12.00  Eva Olsson (Chalmers University, Sweden):  
*In situ studies of electrical and optical properties of quantum devices*

12.00 – 12.30  Robert Sinclair (Stanford University, USA)  
*The influence of electrochemical testing on the structure of oxide, sulphide and nitride thin films, and prospects for in situ studies*

12.30 – 13.30  **LUNCH BREAK & DISCUSSIONS**

Session 3  STRUCTURAL MATERIALS & MECHANICAL PROPERTIES  
Chair: James Wittig

13.30 – 14.00  Julie Cairney (University of Sydney, Australia)  
*Extreme room temperature deformability in ferroelectric oxide pillars*

14.00 – 14.30  Hamish L. Fraser (Ohio State University, USA)  
*Nanoscale structural instabilities in metastable beta titanium alloys and their role in providing both strengthening and low elastic modulus*
14.30 – 15.00 Heike Gabrisch (Helmholtz-Zentrum Geesthacht, Germany)

*Evolution of O-phase domains within alpha2 lamellae of a gamma-TiAl alloy*

15.00 – 15.30 Christoph Kirchlechner (MPI Eisenforschung, Germany)

*Twin boundaries: obstacles for or sources of dislocations?*

15.30 – 16.00 **COFFEE BREAK & DISCUSSIONS**

**Session 4**  
**BIOMATERIALS AND SOFT MATTER**

Chair: Christoph Koch

16.00 – 16.30 Jürgen Plitzko (MPI Biochemie Martinried, Germany)

*In situ structural biology - Cryo-electron tomography of cells and tissue at molecular detail*

16.30 – 17.00 Fu-Rong Chen (City University Hong Kong, China)

*Toward atomic resolution dynamics for soft materials*

17.00 – 18.00 **Lab Tour**

18.00 – 20.30 **Poster Session - contributed posters**

**GET TOGETHER**

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**Oct 29, 2018**

**TUESDAY**

08.30 – 10.00 Registration

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**Session 5**  
**STEM IMAGING AND ANALYSIS**

Chair: Kerstin Volz

09.00 – 09.30 Andreas Rosenauer (Universität Bremen, Germany):

*ISTEM - theory and practice*

09.30 – 10.00 Haijun Wu (National University Singapore, Singapore)

*Seeing structural origins and foreseeing new pathways to improved lead-free piezoelectrics with aberration-corrected scanning transmission electron microscopy*

10.00 – 10.30 Dagmar Gerthsen (KIT Karlsruhe, Germany)

*STEM, FIB-SEM and EDXS tomography of solid oxide fuel cells*

10.30 – 11.00 **COFFEE BREAK & DISCUSSIONS**
Session 6  SPECTROSCOPY  
Chair: Elena Tchernychova

11.00 – 11.30 Gianlugi Botton (Canadian Light Source, University of Saskatchewan and Canadian Centre for Electron Microscopy, McMaster University, Canada)  
*Using electrons and photons for materials characterization: where do we think we stand?*

11.30 – 12.00 Mathieu Kociak (Laboratoire de Physique des Solides, France)  
*Advances in high resolution electron spectroscopies: EELS, EEGS and CL*

12.00 – 12.30 Quentin Ramasse (SuperSTEM, UK)  
*Monochromated STEM-EELS at the nano-scale: balancing momentum and spatial resolution for advanced spectroscopy*

12.30 – 13.30 LUNCH BREAK & DISCUSSIONS

Session 7  MATERIALS FOR ENERGY APPLICATION  
Chair: Joachim Mayer

13.30 – 14.00 Kerstin Volz (Universität Marburg, Germany)  
*4D-STEM for energy materials*

14.00 – 14.30 Elena Tchernychova (National Institute of Chemistry, Slovenia)  
*Structure and defects vs. electrochemical performance in high-power ion batteries*

14.30 – 15.00 Velimir R. Radmilović (NCEM, USA)  
*Imaging and spectroscopy of functional oxide nanowires for energy related applications*

15.00 – 15.30 Thomas Klassen (Helmut-Schmidt-Universität Hamburg, Germany)  
*Nanostructured materials for hydrogen technology*

15.30 – 16.00 COFFEE BREAK & DISCUSSIONS

Session 8  CORRELATIVE MICROSCOPY & ATOM PROBE TOMOGRAPHY  
Chair: Julie Cairney

16.00 – 16.30 Joohyun Lim (MPI Eisenforschung, Germany)  
*Detection of trace impurities and other defects in functional nanomaterials*

17.00 – 17.30 Williams Lefebvre (University Rouen, France)  
*Correlative microscopy by ex situ combination of APT with STEM and preliminary tests for in situ combination of these techniques*
16.30 – 17.00 Christian Liebscher (MPI Eisenforschung, Germany)
How do grain boundaries transform on the atomic level?

17.30 – 18.00 Thomas Kelly (Steam Instruments, Inc., USA)
Project Tomo: Atom Probe and TEM to be combined at last

19:30 CONFERENCE DINNER

ArabesQ
Ludenberger Straße 1-1a
40629 Düsseldorf

Session 9 ADVANCED MATERIALS - ALLOYS & STEELS
Chair: Christoph Kirchlechner

09.00 – 09.30 Joachim Mayer (RWTH Aachen, Germany)
White etching areas - the mistery of premature bearing failures

09.30 – 10.00 Sophie Primig (UNSW Sydeny, Australia)
Microstructure control during advanced manufacturing

10.00 – 10.30 Stefanie Sandlöbes (RWTH Aachen, Germany)
Design of ductile Mg alloys based on combined high resolution electron microscopy experiments and ab initio calculations

10.30 – 11.00 COFFEE BREAK & DISCUSSIONS

Session 10 IN SITU/IN OPERANDO S/TEM
Chair: Christina Scheu

10.30 – 11.00 Sandra van Aert (University of Antwerp, Belgium):
3D atomic scale quantification of nanostructures and their dynamics using model-based STEM
11.00 – 11.30 Damien Alloys (University Paris, France):  
*Unravel the secrets of metal-nanostructure synthesis with liquid-phase TEM*

11.30 – 12.00 Patricia Kooyman (University of Cape Town, South Africa)  
*Development and use in catalysis research of operando transmission electron microscopy*

12.00 – 12.30 Wolfgang Jäger (Universität Kiel, Germany)  
*Advanced and in situ TEM for understanding transport properties of semiconductor interfaces and nanowires*

12.30 – 13.30 **LUNCH BREAK & DISCUSSIONS**

**Session 11  IN SITU ELECTRON MICROSCOPY**  
Chair: Christian Liebscher

13.30 – 14.00 Guillaume Laplanche (Ruhr Universität Bochum, Germany)  
*TEM investigations of microstructural evolution during tensile deformation of high- and medium-entropy alloys*

14.00 – 14.30 Bernhard Völker (Materials Center Leoben, Austria)  
*In situ SEM study of the fracture behaviour of Cr2AlC coatings*

14.30 – 15.00 Erdmann Spiecker (Universität Erlangen-Nürnberg, Germany)  
*In situ electron microscopy of nanomaterials in SEM and TEM: New approaches and applications*

**CONCLUDING REMARKS, COFFEE & FAREWELL**

**END OF WORKSHOP**
List of poster presentations

1. Abdellaoui (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   Correlative Microscopy Techniques for Defect-Property-Correlation of Thermoelectric Materials

2. Ahmad (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   Exploration of the atomic structure of grain boundaries in Cu and Al and their transitions

3. Ahmadian (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   Atomic scale structural and compositional characterization of a $\Sigma 5$ [001] grain boundary in bcc-Fe

4. Arshad (International Islamic University, Pakistan)
   Graphene based nanocomposites for photocatalysis and biomedical applications

5. Aymerich (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   Structure-property relationship studies of Pt/TiO2 nanomaterials for electrochemical applications

6. Beyer (Philipps University Marburg, Germany)
   Quantitative simulation of four-dimensional STEM datasets

7. Bueno (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   Microstructure, thermal stability and defect phonon scattering in AgSbTe2-based thermoelectrics

8. Cautaerts (University of Antwerp / Belgian Nuclear Research Center, Belgium)
   The role of Ti and TiC in Ti-stabilized austenitic steel under ion irradiation

9. Chang (Korea Institute of Science and Technology, South Korea)
   Formation of two dimensional conductive interface by real-time atomic scale crystallization in STEM

10. Changizi (Max-Planck-Institut für Eisenforschung GmbH, Germany)
    Electron microscopy characterization of the octahedral distortion in KCa$_2$Nb$_3$O$_{10}$

11. Dachraoui (Philipps University of Marburg, Germany)
    In situ liquid ec-S/TEM to probe the mechanisms of solid electrolyte interphase formation
12. Devulapalli and Frommeyer (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   From epitaxially grown thin films to grain boundary analysis in Cu and Ti

13. Du (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   Ni-P: microstructure and micro-compression

14. Eljarrat (Humboldt University of Berlin, Germany)
   Relativistic Kramers-Kronig analysis of as-detected low-loss EELS

15. Elsukova (Technical University of Denmark)
   Electron-beam induced cryo-chemical reactions: the case of Organic Ice Resist Lithography

16. Feggeler (University of Duisburg-Essen, Germany)
   X-Ray detected Ferromagnetic Resonance of a single Fe3O4 nanoparticle chain in Magnetospirillum Magnetotacticum

17. Feizpour (Institute of Metals and Technology, Slovenia)
   In-situ heating of composite bimetallic Fe@Au nanoparticles in TEM

18. Firoozabadi (Philipps University Marburg, Germany)
   Energy-filtered STEM – a comparison between experiment and simulation

19. Frank (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   Insights in carbon metal-oxide/sulfide nanohybrid materials by electron microscopy

20. Gännsler (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   3D Reconstruction of Identical Location Electron Micrographs – Methodology and Pitfalls

21. Golizadeh (Montanuniversität Leoben, Austria)
   HRTEM study of metastable phase formation during erosion of composite Al-Cr cathodes during cathodic arc deposition

22. Guo (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   Maximizing ductility in non-equiaatomic single phase FCC high entropy alloys

23. Haas (Humboldt University of Berlin, Germany)
   4D STEM in a modified SEM

24. Heep (Ruhr-University Bochum, Germany)
   APB energy in an AM PX Ni-base superalloy with high γ' volume fraction

25. Hill (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   Study of the degradation mechanisms in polymer electrolyte membrane fuel cells
26. Jeong (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   *Advances in automatic TEM based orientation mapping with precession electron diffraction*

27. Jin (Forschungszentrum Jülich, Germany)
   *Atomic reconstructions at a conducting NdGaO₃/SrTiO₃ heterointerface studied by negative spherical aberration imaging*

28. Kükelhan (Philipps University Marburg, Germany)
   *Composition determination for III-V semiconductors using aberration-corrected STEM*

29. Lee (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   *Direct Observation of Dislocation Plasticity in FeCrCoMnNi High-Entropy Alloys*

30. Li (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   *Twin boundaries as dislocation sources*

31. Liu (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   *Interstitial strengthening as a route towards strong and ductile nanostructured medium-entropy alloys*

32. Lu (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   *In-situ STEM study of precipitation sequences at twin boundaries in high-entropy alloys*

33. Mahfoud (Institute of Materials Research and Engineering, Singapore)
   *Cathodoluminescence study of hybrid plasmonic-metal sulfides materials fabricated at high spatial resolution by electron beam lithography*

34. Mantha (Karlsruhe Institute of Technology, Germany)
   *In-situ Phase Evolution Study in a MnFeCoNiCu High Entropy Alloy*

35. Meiners (Oxford Instruments NanoAnalysis, Germany)
   *Extend your possibilities of EDS in your TEM with our new EDS detector series UltimMax*

36. Michalička (Brno University of Technology, Czech Republic)
   *Tailoring of Shape and Size of Platinum Nanoparticles to Enhance Their Oxygen Reduction Reaction Performance*

37. Olivier (Nelson Mandela University, South Africa)
   *Quantitative determination of structural parameters of V/MgO catalysts prepared using solution combustion synthesis*

38. Pekin (Humboldt University of Berlin, Germany)
   *Four Dimensional Scanning Transmission Electron Microscopy during in situ Annealing of a CuZrAl Bulk Metallic Glass*
39. Persson (Lund University, Sweden)
   *Rotationally asymmetric nanowires studied by electron tomography*

40. Peterlechner (University of Münster, Germany)
   *Intensity time correlations to measure dynamics in amorphous structures*

41. Pokle (Philipps University Marburg, Germany)
   *In Situ Studies for Understanding Intragranular Nanopore Evolution in Ni-rich Layered Oxide Cathode Material*

42. Rao, J. (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   *Hydrogen-microstructure interactions investigation in binary Fe-Cr alloys at small scale*

43. Rao, Z. (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   *Tuning magnetic properties of high-entropy alloys via spinodal decomposition*

44. Sahu (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   *Local strain field in distorted 1T (DT) MoS2 phases by GPA*

45. Schrenker (Friedrich-Alexander University Erlangen-Nuremberg, Germany)
   *Correlative microscopy study on the deformation modes of aligned silver nanowires in transparent electrodes*

46. Schweinar (Max-Planck-Institut für Eisenforschung GmbH, Germany)
   *Probing Catalytic Surfaces by Correlative Scanning Photoemission Electron Microscopy and Atom Probe Tomography*

47. Schweizer (Friedrich-Alexander University, Germany)
   *Low Energy Nano Diffraction (LEND) – Diffraction mode in SEM*

48. Spasova (University of Duisburg-Essen, Germany)
   *Nanoparticles from the gas phase: tuning morphology and surface segregation*

49. Šturm (Jožef Stefan Institute, Slovenia)
   *Radical Transmission Electron Microscopy*

50. Vishal (Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore)
   *Growth of ReS2 thin film and MoS2-ReS2 heterostructure by Pulse Laser Deposition*

51. Vogt (Quantum Design GmbH, Germany)
   *Characterization and control of mass transport in a MEMS-based Nano-Cell for quantitative in situ liquid electrochemical TEM*

52. Wang, H. (Ruhr-Universität Bochum, Germany)
   *Interface dominated cooperative nanoprecipitation in interstitial alloys*

53. Wang, Z. (Sungkyunkwan University, Republic of Korea)
   *Atomic-scale Observation of Dynamic Processes of SrTiO3 (001) Surface Reconstruction at High Temperatures*
54. Wenzel (Karlsruhe Institute of Technology, Germany)  
*Synthesis and Analysis of Highly Reactive Sm Nanoparticles*

55. Widemann (Philipps University Marburg, Germany)  
*Investigations on Beam Influence of in-situ (S)TEM Growth of GaP Nanowires*

56. Wisnet (TVIPS GmbH, Germany)  
*Enabling novel applications in transmission electron microscopy – a camera developer’s perspective*

57. Wittig (Max-Planck-Institut für Eisenforschung GmbH, Germany)  
*Microstructural characterization of high Mn steels using conventional and high resolution transmission electron microscopy*

58. Wochnik (Oxford Instruments NanoAnalysis, Germany)  
*The Benefits & Applications of a CMOS-based EBSD Detector*

59. Wolff-Goodrich (Max-Planck-Institut für Eisenforschung GmbH, Germany)  
*Phase Boundary Chemistry and Structure in B2/L21 Precipitation Strengthened AlCrFeNiTi Compositionally Complex Alloys*

60. Wu, G. (Max-Planck-Institut für Eisenforschung GmbH, Germany)  
*Strong and ductile high entropy alloy composite containing multifold nanotwins*

61. Wu, X. and Makineni (Max-Planck-Institut für Eisenforschung GmbH, Germany)  
*TEM and APT analysis of crystalline defect in Ni-based and Co-based single crystal superalloys*

62. Zhang (Max-Planck-Institut für Eisenforschung GmbH, Germany)  
*Component-based quantification of EELS spectrum imaging*

63. Zhou (Max-Planck-Institut für Eisenforschung GmbH, Germany)  
*Automated grain boundary detection via a machine learning algorithm to assist inplane composition mapping in atom probe tomography*

64. Zingsem (University Duisburg-Essen / Forschungszentrum Jülich, Germany)  
*Nanomagnonic properties of Biogenic magnetite*