MAX-PLANCK-INSTITUT FÜR EISENFORSCHUNG

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, *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
- *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

Contact information e-mail: iamnano2019@mpie.de

Preliminary Conference Program

Oct 27 , 2019 **SUNDAY** 13.30 – 16.30 Registration

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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

Oct 28, 2018 **MONDAY** 08.30 – 10.00 Registration

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

Oct 29, 2018 **TUESDAY** 08.30 – 10.00 Registration

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

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Ludenberger Straße 1-1a

40629 Düsseldorf

Oct 30, 2018 **WEDNESDAY** 08.30 – 10.00 Registration

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 Alloyeau (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 Cr_2AlC 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 ∑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 microcopy characterization of the octahedral distortion in $KCa_2Nb_3O_{10}$

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. Gänsler (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-equiatomic 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 $NdGaO_3/SrTiO_3$ 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 ReS_2 thin film and MoS_2-ReS_2 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