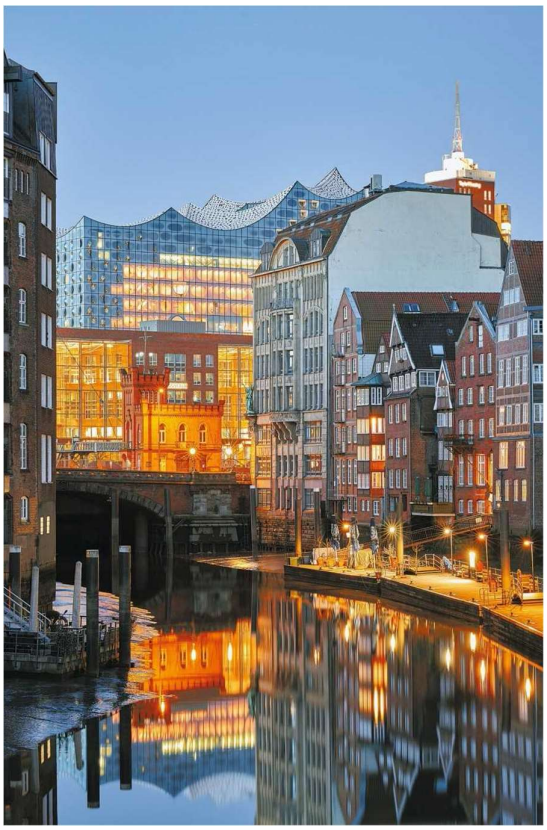
IAMNano 2018 Hamburg

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

October 14 – 17, 2018

Venue: Hotel Empire Riverside, Hamburg
www.iamnano2018.com



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- Conference Report -

An International Workshop on *Advanced and In-situ Microscopies of Functional Nanomaterials and Devices* / www.iamnano2018.com / was held from October 14 – 17, 2018 at the Hotel Empire Riverside in Hamburg, Germany. The workshop was organized commonly by the Institute of Materials Research of the Helmholtz-Zentrum Geesthacht - Centre for Materials and Coastal Research, by the Helmut Schmidt Universität Hamburg, by the TUHH Technische Universität Hamburg, and by the ZHM Zentrum für Hochleistungsmaterialien Hamburg, in collaboration with an international advisory board.

The workshop provided 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, the program covered a wide field of topics of the development of new materials in different technology fields, such as environment and energy materials, engineering, electronics, optics, magnetics, nanosystems, soft matter and bioscience. Novel methodological developments were 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. This workshop was the sixth of its kind, with about 100 participants from Europe, from the Americas (Canada, US), from Asia (Singapore, Japan), and from South Africa who presented their research in more than 50 oral and in 18 poster contributions.

In 8 methodological plenary sessions, internationally renowned invited keynote speakers addressed current developments provided by the aberration-corrected electron microscopy and monochromated spectroscopy, and described the potential of new methodological possibilities. - Some of the topics are summarized as keywords in the following:

- Potentials of aberration-corrected high-resolution transmission (HRTEM) and scanning transmission electron microscopy (STEM): low voltage TEM and 2D materials

- Instrumental developments for advanced in-situ electron microscopy, direct electron and differential phase contrast detectors, data processing methods, equipment for In-Situ and Environmental TEM

- In-situ and environmental transmission electron microscopy, vacancy ordering in ceria films, strain-induced electrical and catalytic activity, in operando TEM for catalysis research, in situ straining and nanoindentation, mechanical and chemical dynamics of oxide interfaces, electron beam driven dynamics in experiment and simulation, ultrafast TEM

- Atomic origin of functionality, quantitative methods of aberration-corrected (scanning) transmission electron microscopy, complex heterostructures, role of interfacial steps in microstructure evolution, role of atomic resolution TEM in development of high-strength steels

- Soft matter and biomaterials, biodegradable Mg implants, X-ray and neutron scattering, hierarchically structured biomaterials

- Electron holography, model-based reconstruction of charge density and electric field, nanoscale electric and magnetic fields, time-resolved electron holography

- Atomic resolution electron tomography, phase-contrast HRTEM, quantitative 3D atomic structure of nanomaterials, electron magnetic circular dichroism

- Spectroscopic methods in TEM and scanning electron microscopy (SEM): electron energy loss spectroscopy (EELS), valence and core-level EELS from low-dimensional materials, high-resolution atomic column EELS of functional oxides, spectra evaluation tools, interfaces in superconductors, EELS applied to plasmonics, quantitative energy dispersive X-ray (EDX) spectrometry, X-ray microanalysis of nanostructures and soft matter

- Strain mapping, 3D reconstruction methods, atom probe tomography, nano-beam electron diffraction

Applications to materials science problems and to the development of advanced engineering materials were described by the invited speakers of the subsequent 4 sessions. Examples covered

- Alloys and steels: structural and functional materials, compositionally complex superalloys, diffusion and diffusion-assisted processes, strengthening of intermetallics, Co-based superalloys
- Materials for energy and environment: catalyst growth and degradation mechanisms, nanostructure materials for hydrogen technology, functional oxide nanomaterials, multilayers for X-ray optics, high-efficiency solar cells
- Nanomaterials: medium range order of amorphous structures, microstructure evolution in nanoscale metal networks, nanomaterials for high-temperature photonics, organically linked nanoparticle supercrystals
- Mechanical properties and interfaces: In-Situ EM of fracture and flow, 3D structure of nanoporous gold and mechanical response, In-Situ TEM of plasticity of a single crystal high-entropy alloy

The oral sessions of the Invited Speakers were complemented by research highlights presented during a special Session of Young Professionals (7 oral presentations) that directly followed the Opening Session, and by a poster session. The broad spectrum of topical areas presented at this workshop is reflected by the contributions that are published in the program and in the abstract booklet of the IAMNano 2018 Hamburg symposium (for details see www.iamnano2018.com).

All participants of this workshop, including especially also the young scientists, were enthusiastic about the scientific program and explicitly gave their positive feedback on the excellent choice of topical subject areas, the quality of the presentations of the invited speakers as well as on the smooth and pleasant overall organization. The concept to combine invited talks of internationally renowned scientists with a Young Professionals session and a poster session attracted also many junior scientists and was successful in initiating contacts and discussions between newcomers and leaders in a broad range of fields.

Three remarks from participants that are representative for the overall positive feedback obtained from the participants (Citations): "Thanks again for organizing a really fantastic conference" - *" …… sind meine Gedanken noch bei der tollen Konferenz. Es waren so wunderbare Vorträge, die mich wirklich sehr bereicherten und die intensiven Diskussionen und manchmal auch nur kurzen Absprachen habe ich sehr geschätzt, und um dieses zu haben, war es doch schon gut, dass wir nicht mehr freie Zeit hatten. …."* - *"Ich moechte mich bei (den Organistoren) fuer die Einladung zu dieser tollen Konferenz bedanken. Die Gastfreundschaft und grosszuegige Organisation hat eine entspannte Atmosphaere zugelassen, in der intensive und offene Diskussionen moeglich waren wie sonst selten."*

Lively discussions and many conversations and networking activities happened during a number of social events that were all well attended, such as the Get-Together on the first evening, the poster sessions, and the conference dinner. The thoughtful choice of the conference venue in the city of Hamburg contributed as well to the extraordinary and memorable success of this conference.

The sponsorships of the following institutions and companies are gratefully acknowledged:

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