



International Conference on Nanoscale  
Catalysis and Energy Conversion

Harnack House Berlin, Germany

November 15-16, 2023

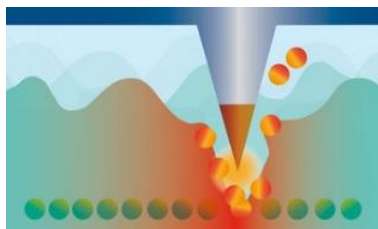
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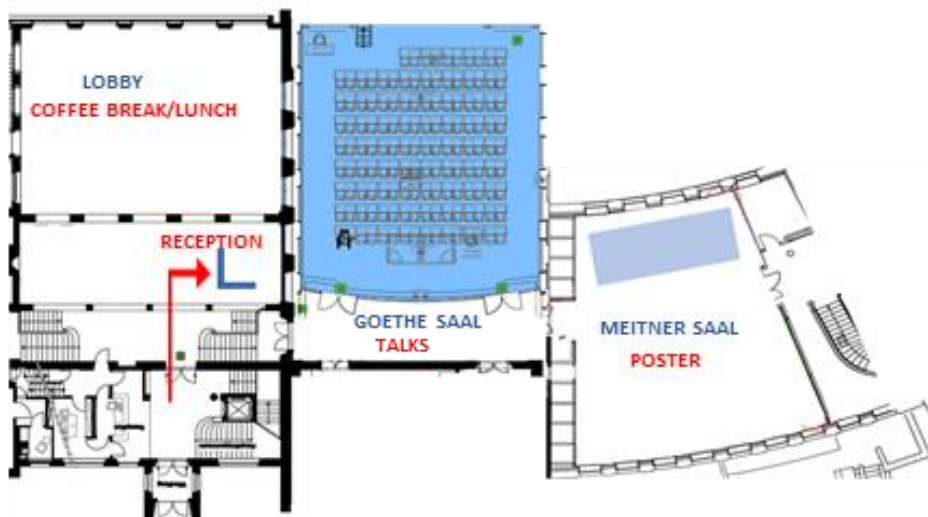
## WELCOME

### 1st International Conference on Nanoscale Catalysis and Energy Conversion

The OPERANDO SPM 2023 conference aims at bringing together scientists, engineers and students interested in *operando* measurement techniques, including scanning probe microscopy (SPM), spectroscopy, and related modelling. The capability to conduct imaging or localized measurements under relevant environmental conditions (*in situ*) or during chemical reactions (*operando*) offers immense potential for research in electrocatalysis, energy conversion and storage, as well as energy materials. Our conference will foster a stimulating environment for discussing cutting-edge topics in electro-/photocatalysis, batteries, and photovoltaics. Leading experts will share the latest breakthroughs in these scientific domains and related *in situ* / *operando* measurement techniques for nanoscale analysis of functional interfaces.



## CONFERENCE ROOMS



MAIN ENTRANCE

## CONFERENCE DINNER

**Wednesday 15, 7:30 pm**

Alter Krug Dahlem

Königin-Luise-Straße 52

14195 Berlin – Zehlendorf

Dinner registration

required!

### How to reach?

The easiest way is by  
public transport:

100 m walk from Harnack Haus to U-Bahn stop "Freie Universität"

take the U3 direction „Warschauer Strasse“ 1 stop to „Dahlem Dorf“

then 100 m to walk



# PROGRAMM OVERVIEW

Wednesday, 15

Thursday, 16

**08:45** Welcome & Talks  
*Chair: Prof. Oleg Kosolov*

**09:00** Talks  
*Chair: Prof. Frieder Muegele*

**10:25** Coffee break

**10:35** Coffee break

**11:00** Talks  
*Chair: Prof. Kislun Voitchovsky*

**11:05** Talks  
*Chair: Prof. Wolfgang Schuhmann*

**12:30** Lunch

**12:30** Lunch

**13:30** Talks  
*Chair: Prof. Takeshi Fukuma*

**14:00** Talks  
*Chair: Prof. Fengtao Fan*

**14:50** Coffee break

**15:20** Coffee break

**15:20** Talks  
*Chair: Prof. Olaf Magnussen*

**16:00** Panel discussion  
*Moderator: Dr. Davide Esposito*

**16:00 – 18:00** Poster Session

**16:45** Poster Award

**19:30** Dinner

## WEDNESDAY, NOVEMBER 15 (registration: 8:00 – 8:45)

<b>08:45</b>	Christopher Kley Florian Johann	Welcome and Introduction
<b>09:00</b>	Prof. Beatriz Roldán Cuenya Fritz-Haber-Institute (DE)	Life and Fate of Energy Conversion Electrocatalysts (Keynote)
<b>09:30</b>	Prof. Wolfgang Schuhmann Ruhr University Bochum (DE)	From single particle electrochemistry to electrocatalyst discovery (Invited)
<b>09:50</b>	Prof. Christine Kranz University of Ulm (DE)	In situ SPM studies of light-driven heterogenized molecular systems (Invited)
<b>10:10</b>	Prof. Georg Papastavrou University of Bayreuth (DE)	New AFM-cantilevers for Electrochemical in-situ Probing on the Local Scale (Contributed)
<b>10:25 – 11:00</b>	<i>Coffee break</i>	<b>10:40 – 11:00 AFM hands-on Session</b>
<b>11:00</b>	Prof. Fengtao Fan Dalian State Key Laboratory of Catalysis (CN)	Spatiotemporal imaging of charge transfer in photocatalyst particles (Invited)
<b>11:20</b>	Prof. Frieder Mugele University of Twente (NL)	In situ and operando characterization of photocatalytically active faceted semiconducting nanoparticles (Invited)
<b>11:40</b>	Prof. Bernhard Roling Philipps University of Marburg (DE)	AFM-based techniques for the electrochemical characterization of solid electrolytes and mixed ion-electron conductors (Invited)
<b>12:00</b>	Dr. Tom Miller University College London (UK)	Electrochemical atomic force microscopy of battery interfaces (Contributed)
<b>12:15</b>	Prof. Florian Hausen Forschungszentrum Jülich (DE)	Mechanical insights on the evolution of functional layers in batteries and electrolyzers (Contributed)
<b>12:30</b>	<i>Lunch</i>	
<b>13:30</b>	Prof. Patrick Unwin University of Warwick (UK)	The new era of high throughput electrochemical multimicroscopy (Keynote)
<b>14:00</b>	Dr. Jan Balajka Technical University of Vienna (AT)	Atomic scale insights into oxide surfaces in aqueous environments (Invited)
<b>14:20</b>	Prof. Olaf Magnussen Christian Albrechts University Kiel (DE)	Scanning tunnelling microscopy studies of Cu surface restructuring during electrochemical CO <sub>2</sub> reduction (Invited)
<b>14:35</b>	Prof. Tomasz Kosmala University of Wroclaw (PL)	Uncovering active sites and enhancing catalytic activity in 2D materials for hydrogen evolution reaction (Contributed)
<b>14:50 – 15:20</b>	<i>Coffee break</i>	<b>15:00 – 15:20 AFM hands-on Session</b>
<b>15:20</b>	Dr. Wei Nie Helmholtz Center Berlin, Fritz-Haber-Institute (DE)	Nanoscale imaging of electrochemical interfaces by operando scanning probe microscopy (Invited)
<b>15:40</b>	Dr. Stacy Moore University of Bristol (UK)	Direct Observations of Electrochemical Processes Using Dynamic Scanning Probe Microscopy (Contributed)
<b>16:00 – 18:00</b>	Poster Session	
<b>19:30</b>	Conference Dinner	

## THURSDAY, NOVEMBER 16

<b>09:00</b>	<b>Prof. Takeshi Fukuma</b> Kanazawa University (JP)	Visualizing EDL structures and chemical reactions by open-loop electric potential microscopy (Keynote)
<b>09:30</b>	<b>Prof. Kislon Voitchovsky</b> Durham University (UK)	Nanoscale probing of ions and water dynamics at interfaces (Invited)
<b>09:50</b>	<b>Prof. Jaime Colchero</b> University of Murcia (ES)	Non-Contact imaging of charges within the Debye Layer using Atomic Force Microscopy (Contributed)
<b>10:05</b>	<b>Prof. Oleg Kolosov</b> Lancaster University (UK)	3D nano-rheology microscopy: Operando nanomapping of 3D mechanical nanostructure of SEI in Na-ion batteries (Contributed)
<b>10:20</b>	<b>Dr. Bizan Balzer</b> University of Freiburg (DE)	Nanoscale programmable friction with ionic liquid mixtures (Contributed)
<b>10:35 – 11:05</b>	<i>Coffee break</i>	<b>10:45 – 11:05 AFM hands-on Session</b>
<b>11:05</b>	<b>Prof. Núria López</b> ICIQ Tarragona (ES)	Developments in CO <sub>2</sub> electrochemical reduction: Insights from theory (Keynote)
<b>11:35</b>	<b>Dr. Nicolas Hörmann</b> Fritz-Haber-Institute (DE)	From Atomistic Interactions to Cyclic Voltammograms and Back Again (Invited)
<b>11:55</b>	<b>Dr. Jun Huang</b> Forschungszentrum Jülich (DE)	Overlapping electric double layers at the mesoscale (Contributed)
<b>12:10</b>	<b>Prof. Stefan Weber</b> University of Stuttgart	The nanoscale photovoltaics laboratory on a tip (Invited)
<b>12:30</b>	<i>Photo &amp; Lunch</i>	
<b>13:50</b>	<b>Dr. Roger Proksch</b> Oxford Instruments Asylum Research (USA)	Accurate multifrequency electromechanics: Electrostatics, Null points and implications for functional nanoelectromechanics (Invited)
<b>14:10</b>	<b>Prof. Tobias Cramer</b> University of Bologna (IT)	Quantitative imaging of electroswelling in organic mixed ionic electronic conductors (Contributed)
<b>14:25</b>	<b>Prof. Elad Gross</b> Hebrew University (ISR)	Operando IR nanospectroscopy mapping of hydrogen dissociation and sorption on single Pd nanoparticles (Contributed)
<b>14:40</b>	<b>Dr. Niklas Biere</b> Oxford Instruments WITec (DE)	Correlative Raman Microscopy for Battery Research (Contributed)
<b>14:55</b>	<b>Dr. Yujin Tong</b> University of Duisburg-Essen (DE)	Characterization of Ultrafast Processes at Electrochemical Interfaces Using Femtosecond Lasers (Contributed)
<b>15:10</b>	<b>Dr. Yu-Ping Ku</b> Helmholtz-Institute Erlangen-Nürnberg (DE)	Degradation of Fe-N catalyst layers in alkaline media
<b>15:25 – 16:00</b>	<i>Coffee break</i>	<b>15:40 – 16:00 AFM hands-on Session</b>
<b>16:00</b>	<b>Panel discussion</b>	Fundamental research and technological innovation in catalysis and energy conversion Moderator: Dr. Davide Esposito, Editor-in-Chief Nature Catalysis
<b>16:45</b>	<b>Poster Award &amp; Closing</b>	

## POSTER OVERVIEW

Poster #01: Johanna Angona, Ruhr-Universität Bochum

*Characterization and Dealloying of Single Micelle-Nucleated AgAu Nanoparticles by Scanning Electrochemical Cell Microscopy*

Poster #02: Daphne Antony, AMOLF

*In-situ probing of adhesion forces at the electrochemical solid-liquid interface*

Poster #03: Zohreh Asadi, FU Berlin

*In-situ and operando studies on the evolution of ZnO:Al in reducing thermal treatment*

Poster #04: Dr. Andrea Auer, Institute of Physical Chemistry, University of Innsbruck

*Visualizing solvent structures at the electrified solid-liquid interface by electrochemical atomic force microscopy*

Poster #05: Lithin Madayan Banatheth, University Duisburg-Essen

*Investigation of phase dependent bifunctional activity of Ni<sub>3</sub>B/Ni<sub>2</sub>B catalysts for water splitting using Scanning Electrochemical Cell Microscopy*

Poster #06: Nicolas Bergmann, FHI Berlin

*Thermodynamic Cyclic Voltammograms from first Principles*

Poster #07: Vladislav Buravet, UCT Prague

*Revealing in-situ activation of TaS<sub>2</sub> towards hydrogen evolution reaction*

Poster #08: Dr. Ana Guilherme Buzanich, BAM Berlin

*Time-, space- and energy-resolved X-ray absorption spectroscopy for in situ characterization of catalysts*

Poster #09: Dr. Giada Caniglia, University of Ulm

*Antimicrobial properties of polydopamine films and the role of surface charge via atomic force spectroscopy*

Poster #10: Lukas Drago Cavar, MPI Polymer Research

*Nanoscale Low-Frequency Dielectric Spectroscopy on Photovoltaic Perovskites*

Poster #11: Filippo Giovanni Fabozzi, HU Berlin

*Dynamic Knoevenagel Condensation for Conjugated 2D-Covalent Organic Framework Formation: From Multilayer to Monolayer*

Poster #12: Dr. Steffen Fengler, Helmholtz Zentrum Hereon

*Investigation of local photocurrent and photopotential distributions on ALD-synthesized TiO<sub>2</sub> photoelectrode coatings*

Poster #13: Katja Frenzel, PTB Braunschweig

*Quantitative X-ray photon beam damage investigations of solid-state electrolytes.*

Poster #14: Ana M. Gómez-Marín, University Duisburg-Essen

*Application of Tip-Enhanced Raman Spectroscopy for characterizing adsorbates at sub(monolayer) coverages*



Poster #15: Philipp Hönicke, HZB

*Towards combined operando electrochemical impedance and X-ray absorption spectroscopy of batteries*

Poster #16: Jun Huang, Forschungszentrum Jülich GmbH

*Are there nontrivial couplings between cathode and anode electric double layers in an electrochemical cell?*

Poster #17: Maria Kelly, NREL Colorado

*Understanding electrochemically driven CaCO<sub>3</sub> nucleation and growth*

Poster #18: Ivan Khalakhan, Charles University

*Tracking fuel cells catalyst aging with EC-AFM*

Poster #19: Dr. Markus Kratzer, Montanuniversität Leoben

*Observing light induced charge propagation through organic epitaxial nanoneedle networks on hexagonal boron nitride*

Poster #20: Yu-Ping Ku, Forschungszentrum Jülich GmbH

*Degradation of Fe-N-C Catalyst Layers in Alkaline Media*

Poster #21: Dr. Peter Matvija, Charles University

*Exploring Fe-modified ceria-based model catalysts through the integration of in-situ near-ambient pressure XPS and STM*

Poster #22: Dr. Martin Munz, HZB & FHI Berlin

*Hydration layer ordering effects at gold–electrolyte interfaces probed by in situ correlative atomic force microscopy and vibrational spectroscopy*

Poster #23: Dr. Kerstin Neuhaus, FZ Jülich

*Determining chemical diffusion coefficients via polarization-relaxation measurements using KPFM*

Poster #24: Dr. Inhee Park, FZ Jülich

*In-Situ electrochemical mapping of local activity on Zn and Zn-Al alloys using scanning electrochemical microscopy (SECM)*

Poster #25: Yujie Peng, HZB & FHI Berlin

*Resolving the morphology and surface structure of CO<sub>2</sub> RR and OER catalysts by in situ AFM*

Poster #26: Dr. Alejandro Esteban Perez Mendoza, University Duisburg-Essen

*Determination of the local potential of zero charge on noble metal-based electrocatalysts using SECCM*

Poster #27: Ali Rafsanjani Abbasi, TU Vienna

*A Comparative Study of Adsorption Sites and Thermal Stability of Platinum and Iridium Adatoms on Fe<sub>2</sub>O<sub>3</sub> ( )*

Poster #28: Simone Reindl, FAU Erlangen

*Implementation of an in situ atomic force microscopy (AFM) setup to study the dynamics of (electro)catalytic interfaces*

Poster #29: Dr. Christian Rodenbücher, FZ Jülich  
*Nanoscale analysis of the electric double layer formed between platinum and the protic ionic liquid [Dema][TfO]*

Poster #30: Pascal Rohrbeck, MPI Polymer Research  
*Nanoscale Surface Photovoltage Spectroscopy*

Poster #31: Konstantin Rücker, DLR Oldenburg  
*Study of the Ionomer Distribution in Catalyst Layers by Atomic Force Microscopy*

Poster #32: Milad Sabzehparvar, EPFL Lausanne  
*Scanning Photo-Electrochemical Microscopy of Hot Carrier Photochemistry on Monocrystalline Plasmonic Nanostructures*

Poster #33: Prof. Giovanni Saenz Arce, Universidad Nacional Heredia  
*Local contact potential of Biofabricated Gold Nanotriangles*

Poster #34: Dr. Raquel Sánchez, Brandenburg University of Technology Cottbus-Senftenberg  
*Oxide formation and oxide/metal interaction in Ni(111)*

Poster #35: Dr. Carla Santos Santana, Ruhr-Universität Bochum  
*SECM tool for investigating charge-transfer processes at interfaces of energy storage devices: from Li batteries to beyond-Li batteries*

Poster #36: Christian Schott, Technical University of Munich  
*Investigating proton reduction and hydrogen absorption on palladium via scanning electrochemical microscopy*

Poster #37: Salbin Sediqi, BAM Berlin  
*Multi-principal element alloy nanoparticle (MPEA-NP) electrocatalysts prepared by pulsed laser ablation for electroreduction of CO<sub>2</sub>*

Poster #38: Dr. Dorothee Silbernagl, BAM Berlin  
*But it is already correlative microscopy*

Poster #39: Dr. Igor Siretanu, University Twente  
*On the relation between colloidal electrostatic and hydration forces on mineral surfaces in ambient electrolytes of variable composition: An Atomic Force Microscopy Study*

Poster #40: Dr. Igor Siretanu, University Twente  
*Towards high efficiency photocatalyst materials: In situ characterization of faceted SrTiO<sub>3</sub> nanoparticle-electrolyte interfaces by Atomic Force Microscopy*

Poster #41: Dimitrios Valavanis, University of Warwick  
*Operando Optical Monitoring of Crystallisation in Confinement*

Poster #42: Xiangdong Xu, University of Warwick  
*Electrochemical Imaging of Thermochemical Catalysis*

## AFM HANDS ON SESSIONS

Live AFM sessions will be given during the second half of each coffee break. It is not required to register for the sessions; however, the attendance will be based on “First Come, First Serve” principle.

Wednesday 15, 2023		
10:40 – 11:00	<b>Cypher ES overview</b>	We will introduce the Cypher ES AFM and the possibilities to measurements under environmental control, including EC-AFM experiments
15:00 – 15:20	<b>Cypher ES overview</b>	
Thursday 16, 2023		
10:45 – 11:05	<b>High-resolution imaging</b>	Tips and tricks on high-resolution (atomic) imaging in liquid solution
15:40 – 16:00	<b>Heterodyne Kelvin Probe Force Microscopy</b>	Implementation of heterodyne Kelvin Probe Force Microscopy for highest quantitative accuracy and high lateral resolution

## PANEL DISCUSSION

This panel discussion will address emerging trends in nanoscale operando microscopy / spectroscopy and computational electro-chemistry, exploring the synergies between academic institutions and industry that have the potential to accelerate technological innovation and the energy transition.

**Moderator:** Dr. Davide Esposito (Chief Editor Nature Catalysis)

**Panellists:** Prof. Núria López (ICIQ Tarragona), Prof. Bernd Rech (Helmholtz Zentrum Berlin für Materialien und Energie), Dr. Günter Schmid (Siemens Energy), Prof. Patrick Unwin (University of Warwick)

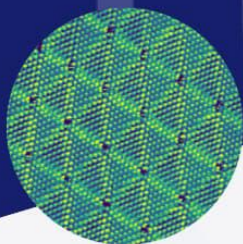
Thursday 16, 2023	
16:00 – 16:45	Nanoscale Analysis for R&D in Catalysis and Energy Conversion

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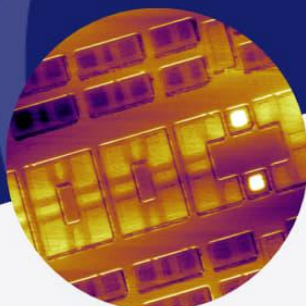
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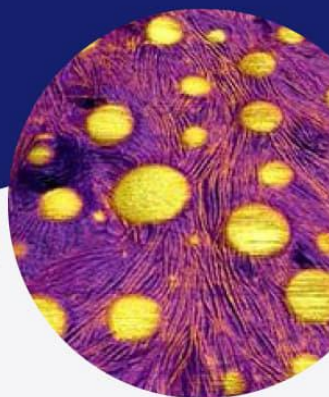
Conductive AFM (CAFM) image of twisted trilayer graphene on hBN, revealing moiré and super moiré patterns

## Going beyond topography

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Surface potential of an SRAM sample using Kelvin Probe Force Microscopy (KPFM)

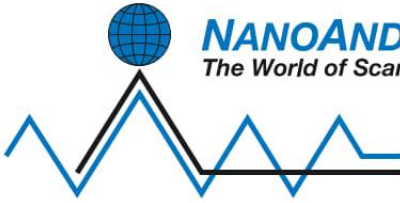


Viscoelastic modulus mapping of a polystyrene (PS) / polycaprolactone (PCL) polymer thin film



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## ORGANIZERS



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## CONFERENCE VENUE

Harnack House - The Conference Venue of the Max Planck Society  
Innestrasse 16-20  
14195 Berlin