MNF Day

POSTERS

2022

Thursday, April 28th

Poster Session I:
9:15am-10:45am

Poster Session II:
11:45am-12:45pm

● First half hour

1. Nicole Janoszka
2. Emma Lomonte
3. Alexander Eich
4. Johann Adrian Preuß
5. Ardavan Makvandi
6. Thorsten Adolphs
7. Niklas Björn Arndt
8. Niklas Vollmar
9. Frank Brückerhoff-Plückelmann
10. Shabnam Taheriniya
11. Margaux Lassaunière
12. Paul Steeger
13. Yorick Post

● Second half hour

1. Cole Bourque
2. Jannis Bensmann
3. Roland Jaha
4. Jan Riegelmeyer
5. Suna Azhdari
6. Mattias Häußler
7. Anna Gibalova
8. Hossein Ostovar
9. Felix Kipke
10. Jędrzej Winczewski
11. Hendrik Voigt
12. Lisa Schlichter
13. Lucas J Kooijman

● *Black dots= posters presented during the **first half hour** of **each** poster session*
● *Red dots= posters presented during the **second half hour** of **each** poster session*
1. *Look for this number to find the corresponding poster during the sessions*

1. Mesoporous multicompartment microparticles from semi-crystalline triblock terpolymer

Nicole Janoszka (AK Gröschel, University of Münster)

Confinement assembly of block copolymers (BCPs) is a versatile way to construct multicompartment microparticles (MMs) with various internal structures. So far, despite an explored range of MMs morphologies, individual microdomains or compartments have not been utilized to create porosity for selective loading or removal. Hence, generated porous MMs of ABC triblock terpolymers have potential applications in nanomedicine, energy storage, or catalysis. A convenient strategy for producing mesoporous MMs is the selective removal of an individual microdomain. In this work, we show the formation of MMs from semicrystalline polystyrene-block-polybutadiene-block-poly(L-lactide) (PS-b-PB-b-PLLA; SBL) by evaporation-induced confinement assembly (EICA) and the generation of mesoporous SBL MMs by hydrolysis of the semi-crystalline PLLA microdomain. For that, we first used a Shirasu Porous Glass (SPG) membrane to generate emulsion droplets with a homogeneous size. After emulsification and EICA process, we dominantly obtained MMs with an inner structure of hexagonally packed core-shell cylinders consisting of a PLLA core, a PB shell, and a PS matrix. For the SBL MMs, increasing crystallinity has influence on the inner morphology. Degradation of the SBL MMs selectively removed the PLLA microdomain forming mesoporous SBL MMs with clear surface roughness. We foresee that mesoporous MMs will serve as platform for nanomedical or catalytic applications as the PB microdomain can be postmodified with various functionalities in a straightforward manner, e.g., click chemistry.

2. The Lithium-Niobate-On-Insulator platform for integrated quantum photonic technologies

Emma Lamonte (AG Pernice, University of Münster)

The on-chip integration of photon sources, reconfigurable optical circuits, and single-photon detectors is a key step toward scalable architectures for optical quantum computing. In this context, the recently developed Lithium-Niobate-On-Insulator (LNOI) technology is emerging as a promising photonic platform thanks to its large second-order nonlinearity, wide transparency range, and high index contrast.

3. Integration of nano-scale quantum emitters with nanophotonic circuits

Alexander Eich (AG Schuck, University of Münster)

The integration of nano-scale quantum emitters with photonic integrated circuits holds great promise for realizing a scalable quantum technology platform. However, the controlled positioning of single emitters in large numbers and with high overlay accuracy to nanophotonic structures is a major challenge. Here we use lithographic patterning techniques suitable for chipscale integration of a wide range of emitter systems, such as quantum dots and defects in nanodiamonds, and show their optical control in nanophotonic circuits.

4. Single-photon emitters in hBN nanocrystalst

Johann Adrian Preuß (AG Bratschitsch, University of Münster)

Efficient single-photon emitters are a crucial prerequisite for quantum optical applications. Recently, single-photon emitters have been discovered in 2D van der Waals crystals. In hexagonal boron nitride (hBN), individual color centers exhibit stable and bright single-photon emission at room temperature. The emitters are not only present in micromechanically exfoliated flakes, but also in commercially available hBN nanocrystals. Using nanopatterned substrates made by electron-beam lithography (Zeiss XB1540 and Raith EBPG5150) and capillary assembly, we create mm² sized arrays of hBN nanocrystals. For the efficient collection of single photons from hBN, we print polymer solid immersion lenses using direct laser writing (Nanoscribe Photonics GT). For this purpose, we use a low-fluorescence polymer resist and prepare the lenses on pre-characterized hBN emitters. Our work on hBN single-photon emitters lights the way to highly efficient single-photon sources at room-temperature.

5. Analytical TEM studies of LiCoO2 thin film electrode for Li-ion batteries

Ardavan Makvandi (AG Wilde, University of Münster)

LiCoO2 is the mostly used cathode material in commercial Li-ion batteries. However, only half of its theoretical capacity can be used due to the structural and chemical instability of its surface at charge voltages higher than 4.2 V. In general, interfaces (e.g. active material/coating, electrode surface/electrolyte) determine the local Li-ion transport kinetics and finally the electrochemical performance. Therefore, it is necessary to study the structure and chemistry of electrodes and electrode/electrolyte interfaces. In this work, the structure and chemistry of the bulk and surface regions of LiCoO2 thin film before and after cycling are studied using transmission electron microscopy (TEM). In this case, the effect of an Al-doped ZnO-coating layer on the stability of the electrode surface upon cycling at high charge voltage has been studied.

6. Matrix Enhancement in Time-of-Flight Secondary Ion Mass Spectrometry

Thorsten Adolps (AG Arlinghaus, University of Münster)

Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS) is one of the most important techniques for chemical imaging of nanomaterials and biological samples with high lateral resolution. However, low ionization efficiency limits detection of many molecules at low concentrations or in very small volumes. One promising approach to increasing the sensitivity of the technique is by addition of a matrix that promotes ionization and desorption of important analyte molecules. This approach is known as Matrix-Enhanced Secondary-Ion Mass Spectrometry (ME-SIMS). We have investigated the effect of matrix acidity on molecular ion formation in three different biomolecules. A series of cinnamic acid-based matrices that vary in acidity was employed to systematically investigate the influence of matrix acidity on analyte ion formation. The positive ion signal for all three biomolecules showed a strong increase for more acidic matrices. The most acidic matrix was then vapor-deposited onto mouse brain sections. This led to significant enhancement of lipid signals from the brain. This work confirms that proton donation plays an important role in the formation of molecular ions in ToF-SIMS.

7. Dynamic Wetting of Self assembled Monolayers and Polymer Brushes

Niklas Björn Arndt (AK Ravoo, University of Münster)

Light is a particularly attractive external stimulus to modify surface properties since it can be applied with very high local and temporal resolution. Molecular photoswitches such as azobenzenes, diarylethenes and spiropyranes have been explored in a range of photoresponsive coatings which utilize their photoisomerization to induce changes in macroscopic properties such as wettability. Current approaches using immobilized photoswitches still suffer from certain drawbacks. Arylazopyrazoles (AAPs) in contrast offer significant improvements of photophysical properties.3 Therefore, the immobilization of AAPs on surfaces using surface bound polymer brushes is predicted to yield surfaces featuring photoresponsive wetting behavior which shows low cycling fatigue and a significant improvement to the photostationary state. Herein we report the synthesis of poly thiolactone polymer brushes using surface initiated atomic transfer radical polymerisation (SI-ATRP). These poly thiolactone brushes are further functionalized with an arylazopyrazole amine and an acrylate. This yields a photoresponsive polymer coating which can change its wetting properties if exposed to UV light. We analyze the polymer functionalized surfaces using atomic force microscopy (AFM), UV/Vis spectroscopy, time-of-flight secondary ion spectrometry (ToF-SIMS) as well as contact angle measurements.

8. Fabrication of phase-change devices

Niklas Vollmar (AG Salinga, University of Münster)

Phase-change materials (PCMs) exhibit a pronounced contrast in electrical and optical properties between their crystalline and amorphous states. Additionally, confined to nanoscopic volumes, they can be switched between these two states within nanoseconds. These properties make them suitable for electronic and photonic memory applications. The physics of their glassy and undercooled liquid states, and their switching mechanism must be further investigated to optimize their function in memory devices, but are also interesting on a fundamental level. We are pushing such studies on multiple fronts. Microscopic heaters (~10 µm wide) enable the investigation of the temporal dynamics of properties in the glassy and undercooled liquid states. The PCM devices must be fabricated directly on top of these heater structures. Holography measurements performed in a transmission electron microscope can uncover the electric field distribution in the amorphous part of electrical PCM devices. For these measurements, the PCM devices must be fabricated on a thin (20 nm) silicon nitride membrane. Confinement can significantly alter the properties of PCMs. For instance, confining amorphous antimony in nanometer-thin films stabilizes it against crystallization. We plan to study the influence of 3D confinement in antimony nanoparticles (~10 nm). To this end, the nanoparticles will be fabricated by depositing thin films on a nano-structured substrate. This poster briefly presents the three ongoing projects described above. We hope for valuable discussions on critical fabrication steps and challenges.

9. Photonic Neuromorphic Computing

Frank Brückerhoff-Plückelmann (AG Pernice, University of Münster)

The rise of AI systems greatly increases the demand for energy efficient, high speed data processing. Therefore, novel brain-inspired computing architectures are developed that are based on the core principles of in-memory computing and parallelization. Here, we present a photonic neuromorphic architecture that deploys non-volatile phase change material for in-memory computation and wavelength multiplexing for parallel data processing.

10. Computing Microstructural modification of nanocomposite HEAs by swift heavy ion irradiation

Shabnam Taheriniya (AG Wilde, University of Münster)

Our earlier report indicates that the nanocomposite high entropy alloys (HEA) produced by high pressure torsion (HPT) after 15 revolutions comprises of three distinct phases. The initial FCC and BCC nanocrystalline phases as well as an amorphous phase which results from elevated stress accumulation and elemental migration into the BCC phase. Since HEAs are considered to be radiation resistant, our motivation was to study their microstructure stability after irradiation by swift heavy ions and use the nanobeam diffraction method to: Demonstrate the effect of irradiation on the structural evolution of severely deformed nanocomposite HEAs produced by HPT Distinguish between different phases and characterize them individually to compare the effect of irradiation under different conditions.

11. Impact of quantum confinement on atomically thin films

Margaux Lassaunière (AG Wurstbauer, University of Münster)

Understanding and controlling the light-matter interaction in thin metal films is of high technological relevance. Here, we study the linear optical response of atomically thin 2D gallium, 2D indium as well as their alloys embedded in half-van der Waals heterostructures by spectroscopic imaging ellipsometry (SIE). The thin films are prepared via confinement heteroepitaxy (CHet). In a systematic study of the dielectric functions, we separate free and bound electron contributions to the optical response, with the latter pointing towards the existence of thickness dependent quantum confinement phenomena and epsilon near zero (ENZ) behavior [1]. The resonance energies of the observed ENZ behavior are dependent on the number of atomic metal layers, materials, and alloying [2]. Their tunability makes 2D polar metals attractive for quantum engineered metal films, tunable (quantum-)plasmonic and nano-photonics. We have discovered that 2D gallium present superconducting properties, whereas 2D silver seems to be a semiconductor.

[1] K. Nisi et al. Adv. Mater. 2021, 2104265
[2] S. Rajabpour et al. Adv. Funct. Mater. 2020, 2005977

12. Strain engineering of 2D semiconductors on the nanoscale

Paul Steeger (AG Bratschitsch, University of Münster)

2D materials have attracted great attention due to their unique electronic, optical, and mechanical properties. Monolayers of transition metal dichalcogenides (TMDCs) represent a group of direct band gap 2D semiconductors, making them promising candidates for novel opto-electronic devices. Their ability to withstand considerable amounts of mechanical strain is remarkable, and also affects their electronic and optical properties. Hence, strain engineering on the nanoscale is a viable approach to deterministically tune the opto-electronic properties of these materials, providing new functionalities, such as exciton funneling and activation of single-photon emitters. This can be achieved by placing monolayers of TMDCs onto prepatterned substrates. Due to adhesive van der Waals forces, the atomically thin crystal folds around the underlying nanostructure. In that way, spatially varying levels of strain are created, which directly translate into a 2D landscape of band gap and exciton energies. In one approach, we stamp a WSe2 monolayer on a submicron gap in a gold nanorod, which leads to the deterministic activation of single-photon emitters with a positioning accuracy better than 140 nm. The gapped nanorods are created from single crystalline gold flakes by focused ion beam milling (Zeiss Auriga Crossbeam). Furthermore, we produce arrays of polymer micropillars on glass substrates using electron beam lithography (Zeiss XB1540). By stamping a monolayer onto these structures, we create strain gradients and are able to steer the diffusion of excitons, which we measure using spatio-temporally resolved photoluminescence. Here, we find that the interplay of dark and bright excitons is crucial to understand charge carrier transport in materials with strong excitonic character. Our results demonstrate that high quality nanostructures are ideal for strain tuning the opto-electronic properties of atomically thin materials.

13. Adaptive polymer morphologies through reversible block fragmentation

Yorick Post (AK Gröschel, University of Münster)

Supramolecular structures, which can be operated out-of-equilibrium, are extremely interesting for the development of intelligent materials. In this project, we aim to develop dissipative nanostructures utilizing a block copolymer that can dynamically alter its composition through energy-driven supramolecular fragmentation. Here, the design and synthesis of such a block copolymer is presented.

1. CryoEM of Complex Nanosystems

Cole Bourque (AG Gatsogiannis, University of Münster)

Our international team is dedicated to elucidating the architecture of complex nanomachines by their direct visualization using cryo-EM. This technique allows us to directly visualize biological samples such as proteins, viruses and large macromolecular complexes down to atomic resolution, purified or even in their functional cellular environment. Combined with biochemical, biophysical, molecular biology, and bioinformatics methods, we can provide crucial mechanistic insights, providing a solid framework for understanding their mode of action.

2. Magnonic nanosystems

Jannis Bensmann (AG Bratschitsch, University of Münster)

Due the ever-increasing demand of computational power, both scientific research and industry strive to boost the performance of computational technology, which manly relies on transistors using charge as information carrier. To continue obeying famous Moore's law of smaller and faster devices, new approaches of building computational systems are required. Here, spintronics is a promising candidate, which uses spin instead of charge. Spin waves and their quantized version, magnons, describe a disturbance of the local magnetization which propagates through a magnetic material. For computing purposes, one can benefit from ample advantages of spin waves, such as low energy losses, broad bandwidth (GHz up to THz), wavelengths in the nanometer range and tunability by external stimuli. Our goal is to realize adaptive magnonic networks consisting of nanoscale waveguides in a magnetic material. As a host material, yttrium iron garnet (YIG) is chosen, which shows low damping and therefore a large spin wave propagation length. The waveguides are fabricated from thin YIG films (~100 nm thickness) using nanofabrication techniques: electron-beam lithography (Raith EBPG5150) is employed to pattern the resist, creating a mask for the subsequent etching step. Since YIG is chemically inert, we use physical sputtering with argon ions (Oxford Plasmapro 100, Meyer Burger Microsys 200) to create the desired nanostructures. To test the quality of the YIG films and the nanofabrication steps, we create YIG disks with a diameter of few µm and characterize them with Brillouin light scattering (BLS). The next step towards a network is the fabrication of elementary building blocks based on spin-wave waveguides, such as intersections. After the deposition of electrically contacted gold antennas using physical vapor deposition (EB-PVD), magnons can be launched inductively in the system. Using BLS, we are then able to detect these spin waves with sub-micrometer resolution.

3. Resistive spot growth in SNSPDs under increased photon illumination

Roland Jaha (AG Pernice, University of Münster)

We investigate the resistive spot growth in u-shaped Niobium nitride (NbN) superconducting nanowire single photon detectors (SNSPDs) under increased photon illumination. We demonstrate the dependence of the nanowire hotspot resistance on the average number of photons per pulse impinging the detector. We observe an increase of the voltage amplitude and a decrease of the rising time for larger photon flux which leads to detection events with ultra-high temporal resolution of only 3.95 ps.

4. Development of a nanophotonic nonlinear unit for optical artificial neural networks

Jan Riegelmeyer (AG Schuck, University of Münster)

Optical artificial neural networks (ANNs) with coherent nanophotonic circuits inspired by signal processing in biological brains hold the potential of fast and energy efficient information processing. However, the implementation of nonlinear nanophotonic components, which are utilized as activation function, remains a major challenge. In our work, we employ nonlinear photoresponsive systems with nanophotonic circuits to develop scalable and reproducible nonlinear building blocks for optical ANNs.

5. Block Copolymers in 3D Confinement: Janus Nano Cups

Suna Azhdari (AK Gröschel, University of Münster)

Block copolymer nanoparticles with complex surface outstanding morphologies are in high demand as non-trivial soft matter due to their exclusive physical properties. In comparison to topologies such as spheres, vesicles and cylinders, the precise formation of patchy polymeric cups with defined surface structure are still rare. Geometrically controlled anisotropic Janus nanoparticles (JNP) have gained considerable interest in the polymer science community. However, currently only a few controlled bottom-up synthesis routes are known that enable JNPs synthesis with high selectivity towards the desired geometries. In the present work, we aim to achieve cup-shaped JNPs and the control of their size and curvature. First, several ABC triblock terpolymers consisting of polystyrene-b-polybutadiene-b-poly (tert-butyl methacrylate) (SBT) are emulsified in conjunction with high-molecular poly (methyl methacrylate) (PMMA) in varying blending ratios through a SPG membrane, followed by evaporation-induced confinement assembly (EICA) process. This led to the formation of two hemispherical particles, with PMMA forming a hemisphere on its own and SBT instead, arranging in a concentric lamella-lamella morphology. In the second step, the PB microdomain is crosslinked with OsO_4, and the PMMA hemisphere is subsequently removed by washing with THF, whereby dispersed cup shaped JNPs are obtained. The curvature of the JNPs is controlled by the blending ratio of PMMA, as its content increases the more the curvature is decreasing, going from hemispheres to cups to disk like particles. The mechanical stability of the JNPs is controlled by the length of the PB phase through cross-linking, preventing the collapse of the cups. By removing the PMMA phase with THF and redispersion the SBT tulip bulb phase, it is possible to produce Janus nano-cups in high yield. Further, the PT nanodomain is hydrolyzed, in order to produce negative charges, that can be paired with cationic species, e.g. Au NPs, in order to prove the Janus character. Due to the particular shape, the Janus nano-cups may find application in biotechnology and nanomedicine, as well as templating of inorganic materials and to perform as cargo in biotechnology and nanomedicine due to their cup-like shape.

6. Waveguide-Integrated Single-Photon Detectors for Applied Quantum Technologies

Matthias Häußler (AG Schuck, University of Münster)

The efficient detection of quantum states of light is of crucial importance for modern quantum technologies like quantum communication and linear optical quantum computing. As of today, superconducting single-photon detectors are the most promising candidates for performing this task. Based on sub-micrometer structures, their fabrication constitutes a major challenge and requires for advanced nanofabrication techniques. Here we show how these detectors can be combined with integrated photonic circuitry for realizing widespread functionality.

7. Light responsive conductive surface coatings on the base of azidomethyl-PEDOT films

Anna Gibalova (AK Ravoo, University of Münster)

Light-responsive interfaces receive particularly noticeable attention with many popular immobilization strategies focusing on the formation of self-assembled monolayers providing reversible surface wettability or adsorption. A promising alternative approach to immobilize multi stimuli-responsive building blocks on the surface and to considerably increase the surface concentration is electropolymerization. In this project, we studied the possibility of the use of electropolymerized azidomethyl-PEDOT polymer as a substrate for developing light-responsive coatings based on click chemistry. Arylazopyrazole moiety was chosen for the surface modification due to its outstanding photochemical performance as well as easy synthetic accessibility.

8. Quantum emitters on demand in 2D materials

Hossein Ostovar (AG Wurstbauer, University of Münster)

The peculiar properties of 2D materials such as transition metal dichalcogenides (TMDCs) in the monolayer limit and hexagonal boron nitride (hBN) gained a lot of interest both in fundamental research and technological applications in recent years. The nature of van der Waals bonding between atomic layers of these materials paves the way for creating heterostructure with unique optoelectronic properties. One of many interesting features of these materials is their ability to host single photon emitters (SPEs) with atomistic precision at least in one spatial direction both occurring naturally or via manipulation such as deterministic defect implantation. Furthermore, it has been shown that characteristics of these SPEs can be tuned via external stimuli such as electrical and magnetic field or local strain, to name a few. In this work, we have studied the naturally occurring SPEs in hBN and deterministically defect induced SPEs in TMDCs via Helium ion irradiation. The characteristics of these SPEs are investigated by temperature dependent photoluminescence (PL) and more novel methods such as Cathodoluminescence (CL) spectroscopies.

9. Electrochemical driven Self-Holding Optical Actuator

Felix Kipke (AG Bracht, University of Münster)

An optical actuator system is proposed based on the switching properties of mixed ionic electric conductors (MIECs), such as V_2O_5 and WO_3. In recent experiments, a multilayer stack forming a battery-like system was sputtered, where ions reversibly travel from a Li-ion source to a $Li_xV_2O_5$ layer. By electrochemically changing the composition of the $Li_xV_2O_5$ layer, the desired change of the optical properties is realized. Simulations and measurements suggest promising results for a potential actuator system, like small device length, low power consumption, reversibility, and time stability. The objective of this project is to implement the described actuator onto a photonic chip, characterize its optical properties as a function of ion content in the MIEC material, determine the capability to modulate light propagation through a silicon waveguide as well as to analyze its actual reversibility and time stability.

10. Additive manufacturing of 3D luminescent microstructures

Jędrzej Winczewski (Mesa + Institute, University of Twente)

Recent years resulted in significant progress in the additive manufacturing of three-dimensional (3D) architectures using two-photon lithography (TPL). However, in practice, the commercial TPL photoresins permit the manufacturing of solely organic polymeric structures [1]. These materials exhibit limited chemical and thermal stability, which restricts the expansion of TPL towards different application fields. An alternative approach focuses on developing tailor-made photoresins containing inorganic additives, i.e., salts [1-4]. The 3D structures printed from such resins transform into the corresponding metal or metal oxide miniaturized replicas upon thermal processing. Examples of materials printed via TPL include TiO_2,[2] Ni [3], ZnO[4]. Here, we present additive manufacturing of 3D architectures of arbitrary shapes composed of tetragonal (t-) and monoclinic (m-) ZrO_2 [1]. Our Zr-rich photoresin shows compatibility with the Eu-additive, which allows us to modify the resulting 3D ceramics with a luminescent activator [1]. The emission properties of our Eu-doped ZrO_2 3D architectures are studied with cathodoluinescence [1]. The ZrO_2-hosted Eu shows an orange-red emission. The presented additive manufacturing approach offers new structuring possibilities for the future development of 3D luminescent devices [1].

[1] J.P. Winczewski et al., Additive manufacturing of 3D luminescent $ZrO_2:Eu^{3+}$ architectures; Adv. Opt. Mater. (2022), Accepted.
[2] A. Vyatskikh, et al., Additive manufacturing of high-refractive-index, nanoarchitected titanium dioxide for 3D dielectric photonic crystals; Nano Lett. (2020), 20, 3513.
[3] D.W. Yee et al., Additive manufacturing of 3D-architected multifunctional metal oxides; Adv. Mater. (2019), 31, 1901345.
[4] A. Vyatskikh, et al., Additive manufacturing of 3D nano-architected metals; Nat. Commun. (2018), 9, 593. [5] C. Tiseanu et al., Order and disorder effects in nano-ZrO_2 investigated by micro-Raman and spectrally and temporarily resolved photoluminescence; Phys. Chem. Chem. Phys. (2012), 14, 12970.

11. Analytical Transmission Electron Microscopy studies on PdNiS metallic glass revealing structural information and relaxation dynamics

Hendrik Voigt (AG Wilde, University of Münster)

Metallic glasses have been the focus of many studies in the last decades. The manufacturing of such metallic glasses usually is achieved through rapid quenching of a metallic alloy in its liquid state. The addition of different alloying materials can have a drastic impact on the glass forming ability (GFA). Unfortunately, the mechanics behind this process have not been fully revealed yet [1]. The ternary system PdNiP has been investigated since the 70s [2] accompanied by the interest in the bonding nature of the Phosphorus and which impact this element has on the medium range order and the relaxation dynamics of the sample system. Only recently it has been shown that Phosphorus can be exchanged with Sulfur while maintaining glass forming ability [3]. In this study the impact of sulfur on the Medium Range Order (MRO) through Variable Resolution Fluctuation Electron Microscopy (VR FEM) measurements via the acquisition of nanobeam diffraction pattern series with systematically varied beam sizes is investigated. Additionally, the relaxation dynamics are examined using Electron Correlation Microscopy (ECM) from a time series of tilted dark field (DF) images. The microscope used for these applications is a (Scanning) Transmission Electron Microscope (S)TEM.

[1] H. Jiang, J. Hu, N. Neuber, B. Bochtler, B. Adam, S. Riegler, M.Frey, L.Ruschel, W. Lu, A. Feng, R. Busch, J. Shen, Scripta Materialia (2021) 116923
[2] P.L.Maitrepierre, J. Applied Physics (1969), 4826
[3] A. Kuball, O. Gross B. Bochtler, R. Busch, Scripta Materialia (2018), 73

12. Self-Assembly of Hybrid Nanostructures for Brain Inspired Electronics

Lisa Schlichter (AK Ravoo, University of Münster)

We want to achieve reconfigurable computational functionality in a designless nanoparticle (NP) network for unconventional computing using artificial evolution in nanoscale materials. In a preliminary work, reconfigurable Boolean logic was realized in a disordered network of gold NP (AuNP) interconnected by 1-octanethiols which are trapped in a circular region between electrodes. At low temperature, each NP exhibits a Coloumb blockade and acts as single electron transistor (SET). When sufficient energy is available, one electron per time can tunnel (ON state). Otherwise, the transport is blocked (OFF state). Since the transport mechanism across the network results in very complex behavior, these nanoscale devices are trained using 'Evolution-in-Materio'. In this project, different organic ligands on the NPs acting as tunable tunnel barriers that add memory functionality to the network are studied.

13. ordered symmetrical Surface-Enhanced Raman Scattering (SERS) gold nanostructures

Lucas J Kooijman (Mesa + Institute, University of Twente)

This work shows the fabrication and characterization of ordered symmetrical Surface-Enhanced Raman Scattering (SERS) gold nanostructures. The fabrication process consists of the shaping of nano-wedges in Si and the shaping of the Au structures on top of that. The SERS activity was analysed by calculating the analytical enhancement factor (AEF) from finite-difference time-domain simulations and optically from the fabricated structures characterised.

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