MAPEX Bremen
Material. Process. Excellence.

6th MAPEX Early Career Researcher Workshop

Programme

25th April 2018
TAB Building

BUILDING BRIDGES | across the borders defined by the faculties and institutes

MAPEX
Materials Methods Technologies

Early Career Researcher Workshop

Universität Bremen

BUILDING BRIDGES | across the borders defined by the faculties and institutes

MAPEX Early Career Researcher Workshop

PROGRAMME - overview

8:00	Registration and poster mounting
8:30	Session 1
9:45	Coffee break
10:00	Session 2
11:45	Poster session and lunch
13:00	Session 3
14:00	Poster session and coffee break
15:00	Plenary lecture
16:00	Discussion and coffee
	Social event
16:34	Bus 28 from Uni Nord to Waller Ring
17:00	Hafenrummel (Am Speicher XI 11, 28217 Bremen)
19:00	Dinner Feuerwache (Waller Stieg 5, 28217 Bremen)

Session 1

08:30 Welcome

Hanna Lührs, MAPEX

08:45 Helical composite fibers for advanced actuators

Dorothea Brüggemann, FB01, Biophysics
Michael Maas, FB04, Advanced Ceramics

In this collaborative project, we develop a new extrusion approach through rotating magnetic fields to process natural polymers into helical nano- and microfibers with embedded superparamagnetic nanoparticles. These fibrous composites form a new class of bioactive actuators with tailored composition, mechanical properties and biofunctionality, which can potentially be used as artificial muscles in future regenerative medicine applications. The overarching project goal is to establish a new collaboration between the Emmy-Noether group of Dorothea Brüggemann at the Biophysics Institute (FB1) and the group of Michael Maas within the Advanced Ceramics group (FB4).

9:15 Flashlight Presentations

L1 **In situ growth analysis of moderately and highly strained vanadium dioxide thin films**

Simon Fischer, FB01, Institute of Solid State Physics

VO_2 is attractive for switching devices and sensing applications because of its pronounced temperature-induced metal-insulator transition. In thin films, the transition temperature is strain-dependent, thus allowing for tuning the transition temperature. We have employed an activated oxygen source to perform in situ LEEM studies of epitaxial VO_2 thin film growth on TiO_2 and RuO_2 substrates, enabling a systematic comparison of the influence of the strain exerted by the substrate on the growth.

L2 **In-Situ Characterization and Thermal Decomposition Behavior of Ammonium-Exchanged Chabazites**

Ahmed Gadelmawla, FB05

Single crystals and powder samples of natural Ca chabazite (New Zealand) with chemical composition $Ca_{2.18}[Al_{4.36}Si_{7.64}O_{24}]\cdot 12H_2O$ were NH_4 exchanged and investigated by X-ray methods (Single crystal & powder diffraction), EDX, TG-IR-MS and FTIR analyses. The thermal stability was assessed with in situ high-temperature X-ray diffraction experiments using a Paar HTK heating chamber.

L3 **Constructed models for Rutile**

Filippo Balzaretti, FB04, Universität Bremen

The importance of TiO_2 has been worldwide recognized due to its outstanding photocatalytical properties and chemical stability, which can be of major relevance even for a huge problem such as wastewater. Within different levels of accuracy (from Density Functional Theory to Force Fields) a satisfying study of Rutile facets, including environmental aspects, is the real focus of my work.

L4 **Optimizing tool layout of a fixture hardening process by finite element simulation**

Hannes Birkhofer, FB04, Leibniz IWT

Press quenching or fixture hardening is a heat treatment technique utilized to control dimension and form changes of steel parts by constraining their shrinkage. The key mechanisms and variables encountered are heat transfer by the cooling medium, thermal and transformation strains, transformation plasticity, transformation kinetics and the specific tool design e.g. the mandrel dimension. Simulations are used to improve currently applied trial and error strategies applied in tool set-up.

09:45 Discussion and coffee

Session 2

10:00 Funding Schemes for Postdocs (University of Bremen, DFG, DAAD, EU)

Uta Brathauer, Research Services Unit
Andrea Gottlieb, Research Services Unit

11:00 Support of early-career researchers at the University of Bremen

Marie Sander, Bremen Early Career Researcher Development (BYRD)
Imke Girßmann, Bremen Early Career Researcher Development (BYRD)

11:15 Flashlight Presentations

L5 **In situ studies of transition metal dichalcogenides growth**

Moritz Ewert, FB01, Institute of Solid State Physics - Surface Physics

Transition metal dichalcogenides (TMDCs) exhibit graphene-like electronically properties, but, contrary to graphene, a sizable direct band gap. In this project, we use in situ low-energy electron microscopy and diffraction to follow the early nucleation stages and the formation of two-dimensional MoS_2 islands under ultra-high vacuum conditions. Complementary structural and chemical information is obtained from X-ray photoelectron spectroscopy and scanning tunnelling microscopy measurements.

L6 Rapid Forming – Sheet metal forming with flexible tools

Björn Beckschwarte, FB04, bime

Sheet metal forming tools for conventional processes are made of steel that have to be manufactured in time and cost intensive processes. Furthermore, these manufacturing processes don't feature a modification of the geometry. In times of personalized products the tool concepts need to be rethrought in combination of the forming process. Here, high-speed forming processes enable the use of new tool materials that are flexible in the sense of tool production and reconfiguration.

L7 Synthesis and Photocatalytic Activity of Nanoporous Gold – Zinc Phthalocyanine Hybrid Materials

David Steinebrunner, FB02, Institute of Applied and Physical Chemistry

Nanoporous gold – zinc phthalocyanine hybrids have been found as efficient photocatalysts producing singlet oxygen in high quantum yields. In this study a new series of np-Au – ZnPc hybrids was prepared and analyzed regarding the amount and distribution of ZnPc immobilized on the porous substrate. In addition the photocatalytic activity and the synergistic effect of the photosensitizer and the surface plasmons of the substrate were investigated by irradiating with light of different wavelengths.

L8 Experimental analysis of material flow by planar swaging

Johannes Hochbein, FB04, bime

Rotary swaging is a cold forming process for reducing the diameter of rods or tubes. The incremental forming causes a local material flow both in radial and axial directions. Axially, the material flows not only in feed direction but also backwards. Such fluctuations in the material flow are difficult to analyze in conventional swaging process. A newly proposed planar test rig allows the visualization of the material flow along the formed part and analyzing of the single stroke as well.

Poster session & lunch

11:45 Postersession & Lunch in the TAB

Session 3

13:00 Material Synthesis in Variable Gravity

Martin Castillo, FB04, ZARM

The Energy Efficient Materials in Variable Gravity (Raumfahrtbezogene Energieeffiziente Materialien, REM) Group is the creation of a new department dedicated to the creation of energy efficient materials and renewable energy systems related to space with benefits on earth. This presentation will focus on the work of the group leader of REM, Dr. Castillo, in the area of synthesis of materials in variable gravity.

13:30 Flashlight Presentations

L9 **Electrohydraulic Incremental Forming**

Lasse Langstädtler, FB04, bime

Electrohydraulic forming is a working media based high speed process. Beneath the decreased plasticity of deformed material, the process features a contactless force transmission with high pressures up to several gigapascal. However, depending on the application the deformation energy can't be transferred within one step. Hence, a new incremental electrohydraulic forming strategy is presented. This incremental character features economical as well as ecological advantages.

L10 **Polyphosphazenes as Precursors for the SEI Formation on Lithium Metal Anodes**

Gideon Abels, FB04, Fraunhofer IFAM

The use of high-capacity anodes from metallic lithium in lithium-ion batteries requires a stable interface towards the electrolyte to suppress unwanted side reactions of the metal. A possible route is the formation of an artificial SEI, for example LiPON. However, the latter can only be applicated in small scale. An interesting alternative are polyphoshpazenes, which could be modified to decompose to the same products as LiPON and should be easier to process, allowing an upscaling.

L11 **Thermal annealing effects on optical properties of 2D MoS2**

Oleg Gridenco, FB01, Institute of Solid State Physics

Mechanically exfoliated MoS_2 monolayers obtained from natural crystals and deposited by a polymer transfer process on substrates suffer from residues on the surface, the residues as well as adsorbed O_2 and H_2O at the surface of a monolayer are known to modify the optical and electrical properties resulting in a quenching of the photoluminescence (PL). We present a systematic thermal annealing study conducted by heating and laser annealing in order to remove such residues.

L12 **Temperature-dependent behavior of vanadium-bearing porous materials**

Rosa Micaela Danisi, FB05, Crystallography

Great attention has recently been paid to incorporate vanadium into porous materials to change their physicochemical properties. However, fundamental observations on the temperature-dependent behavior of vanadium-bearing materials are missing. My research project is therefore aiming to investigate the thermal behavior of synthetic vanadium-containing microporous frameworks. The synthesized materials will be used to perform in situ X-ray diffraction experiments focusing on the investigation of temperature-dependent structural modifications.

Poster session & coffee

14:00 Postersession and coffee

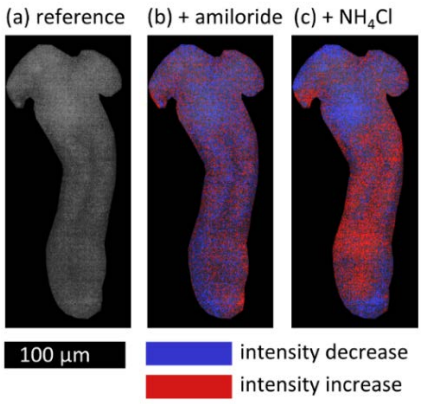
15:00 Plenary lecture

Semiconductor nanostructures - smart probes for biological systems

Martin Eickhoff, Solid State Materials, FB1, Institute of Solid State Physics
eickhoff@ifp.uni-bremen.de

The development of advanced synthesis techniques for semiconductor nanostructures allows for controlling their electronic and optical properties and thus for fabricating nanoscale devices with well-controlled properties. Here we show how the surface properties of the material determine the chemical sensitivity as for example the responsivity to changes in the ion concentration when operated in liquid electrolytes under physiological conditions. Semiconductors of the group III-Nitride material system (GaN, InN, AlN) exhibit an excellent electrochemical surface stability that can be combined with the high responsivity to changes in the proton concentration, i.e. the pH value, of electrolyte solutions. Moreover, chemical surface functionalization allows for the covalent immobilization of biomolecules on the surface of transistor structures, thus enabling electrical readout of their functionality. Enzmye-modified field-effect transistors (EnFETs) are discusses as a model system, as they allow a quantitative analysis of the enzyme functionality after immobilization on a semiconductor surface.

Due to the excellent optoelectronic properties of the group III-nitride materials it is possible to synthesize nanowires with a diameter below 50 nm that exhibit intense photoluminescence. In this case, the intensity of the luminescence light sensitively responds to changes in the chemical environment that can be recorded by optical detection. For the case of two dimensional nanowire arrays as optochemical electrodes this allows for dynamic imaging of biochemical or cellular processes (*Figure 1*).



We will give an overview on the physical properties of different group III-nitride nanostructures and discuss selected examples for probing of biological systems.

Figure 1. *(a) Spatially resolved image of the colonar crypt form a Wistar rat on top of a InGaN nanowire array in the presence of modified Tyrode´s solution as reference. (b), (c) Intensity decrease (blue) and increase (red) after blocking the sodium-proton-exchange in the cell membrane with amiloride (b) and after addition of NH_4Cl. That is taken up by the cells as NH_3 via nonionic diffusion across the cell membrane (c).*

Notes …

Social event and dinner

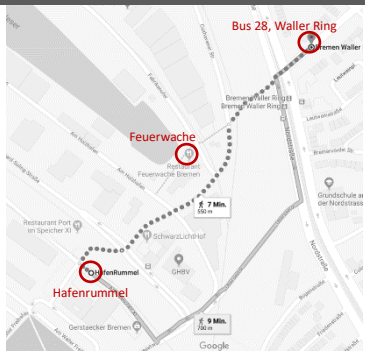
16:00	**Discussion & coffee in the TAB**
16:30	**Travel to Hafenrummel**
17:00	**Hafenrummel**
19:00	**Dinner in Restaurant Feuerwache**

How to get there?

By bus/tram:
Linie 28 (Uni Nord to Bremen Waller Ring)
16:34 (every 20 minutes)
5 minutes walk (follow Waller Stieg and Cuxhavener Straße)

Hafenrummel, Am Speicher XI 11, 28217 Bremen

Feuerwache, Waller Stieg 5, 28217 Bremen



List of Participants

1. **Gideon Abels**, FB04, Fraunhofer IFAM
2. **Gabriela Alexe**, FB04, BIMAQ
3. **Iva Bacic**, FB04, Hybrid Materials and Interfaces, bime
4. **Filippo Balzaretti**, FB04, Universität Bremen
5. **Björn Beckschwarte**, FB04, bime
6. **Hannes Birkhofer**, FB04, Leibniz IWT
7. **Uta Brathauer**, Research Services Unit
8. **Dorothea Brüggemann**, FB01, Biophysics
9. **Nele Bühren**, FB04
10. **Martin Castillo**, FB04, ZARM
11. **Rosa Micaela Danisi**, FB05, Crystallography
12. **Vita Daudaravičienė**, Kaunas University of Technology, Lithuania
13. **Bastian Dincher**, MAPEX
14. **Nelson Ehling**, FB04
15. **Martin Eickhoff**, FB01, Institute of Solid State Physics
16. **Moritz Ewert**, FB01, Institue of Solid State Physics - Surface Physics
17. **Simon Fischer**, FB01, Institute of Solid State Physics
18. **Michael Fischer**, FB05, Fachgebiet Kristallographie
19. **Thorben Fröhlking**, FB04
20. **Ahmed Gadelmawla**, FB05
21. **Imke Girßmann**, BYRD
22. **Andrea Gottlieb**, Research Services Unit
23. **Oleg Gridenco**, FB01, Institute of Solid State Physics
24. **Johannes Hochbein**, FB04, bime
25. **Ron Hoffmann**, FB02, Fraunhofer IFAM
26. **Susan Köppen**, FB04, BCCMS
27. **Lasse Langstädtler**, FB04, bime
28. **Hanna Lührs**, MAPEX
29. **Michael Maas**, FB04, Advanced Ceramics
30. **Inga Meyenborg**, FB04, Fraunhofer IFAM

List of Participants

31. **Jan-Hendrik Ohlendorf**, FB04, Institut für integrierte Produktentwicklung (BIK)
32. **Georg Pesch**, FB04, UFT, AG Thöming
33. **Nils-Christian Petry**, FB04
34. **Benny Rievers**, FB04, ZARM
35. **Marie Sander**, Bremen Early Career Researcher Development
36. **Christian Schenck**, FB04, bime
37. **Stephani Stamboroski**, FB05
38. **David Steinebrunner**, FB02, Institute of Applied and Physical Chemistry
39. **Dirk Stöbener**, FB04, BIMAQ Bremen Institute for Metrology, Automation and Quality Science
40. **Laura Strodtmann**, Christian-Albrechts-Universität zu Kiel
41. **Vanessa van Laack**, FB02, Fraunhofer IFAM
42. **Maria Isabel Velez**, FB04
43. **André Wark**, FB02, Hybrid Materials and Interfaces

Organizing committee

Hanna Lührs, MAPEX
Nele Bühren, MAPEX
Bastian Dincher, photographer

6th MAPEX Early Career Researcher Workshop

The workshop aims to bring together Early Career Researchers (PhD and MSc candidates, post-docs) from the University of Bremen and surrounding institutions who would like to find out more about ongoing research activities in the field of materials science. The workshop will comprise presentations by MAPEX early career investigators who will highlight different aspects of the MAPEX research landscape. The participating PhD and MSc candidates will have the opportunity to present their research in poster presentations, accompanied by short oral “flashlight presentations”. The poster sessions will provide plenty of time for discussions in order to connect participants from different areas of MAPEX. A highlight will be the plenary lecture by Martin Eickhoff, newly appointed professor for solid state materials in the Institute of Solid State Physics at the University of Bremen. After a day full of scientific insights, the day will close with a visit of the "Hafenrummel", where we will test our luck and skill on a course of fairground attractions of the 1950ies.

The workshop is a good platform for you to…

- get in touch with peers, build up your own network of experts,
- learn from others, think outside the box,
- open doors to other experts – become aware of the huge potential for mutual support that you can access on the short way,
- develop ideas for cooperative research projects.

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