



4th MAPEX Early Career Researcher Workshop

Programme

11th May 2017

TAB Building

**BUILDING
BRIDGES**

across the borders defined
by the faculties and institutes



MAPEX

Materials Methods Technologies

**Early Career Researcher
Workshop**

4th MAPEX Early Career Researcher Workshop

Overview

- 8:30** Registration and poster mounting
- 9:00** Session 1
- 10:30** Coffee break
- 11:00** Session 2
- 12:00** Poster session and lunch
- 14:00** Session 3
- 15:00** Coffee break
- 15:30** Session 4
- 16:00** Plenary lecture
- 17:00** Poster session
- 18:00** Dinner
- 19:00** Video clips
- 20:30** Night watchman city tour
(meet in front of the cathedral in the city centre)

Session 1

09:00 Opening, introduction to MAPEX

Hanna Lührs, MAPEX

09:30 Printed sensor structures for material integrated sensing

Gerrit Dumstorff, FB01, IMSAS

There is a strong trend in getting physical measurement quantities, like strain or temperature, out of a material. In this field a new approach are printed sensors and their integration into different materials. The presentation will focus challenges and results towards the integration of printed strain and temperature sensors in steel, aluminum, carbon fiber reinforced plastics and rubber.

10:00 Lightning Presentations

L1 Protein nanofibres as cellular interfaces

Naiana Suter, FB01, Biophysik

We study the interaction of cells with nanofibrous collagen meshes, which were prepared in a self-assembly process. 3T3 fibroblasts were cultivated on the nanofibrous meshes to analyse the biofunctionality. Using light microscopy we observed good viability of the cells. We analysed the morphology of cells with scanning electron microscopy and observed that fibroblasts were growing towards areas, which were covered with protein nanofibers, thus indicating a positive cellular response.

L2 Assembly of extruded protein nanofibers via biochemical modification

Karsten Stapelfeldt, FB01, Biophysik

We study the influence of biochemical modifications on the assembly of protein nanofibers formed by extrusion through alumina nanopores. The nanopores were functionalized using silanization or polymer coatings to add different functional groups on the alumina surface. Further on, the pH and ionic strength during extrusion were adjusted using different buffers. Scanning electron microscopy revealed that the presence of charged groups is a key parameter, which influences the fibre assembly.

L3 Porous ceramics nanocomposites with entrapped biofunctionality for biotechnological applications

Jessica Condi Mainardi, FB04, Advanced Ceramics

The incorporation of bacteria into a highly accessible porous matrix opens up new perspectives for biotechnological applications. In this project, a biocompatible one-pot process based on the ionotropic gelation of biopolymers will be used to generate porous oxide ceramic nanocomposites with biological entities that are entrapped inside the nanocomposite matrix.

L4 Nanoscale Janus particles with dual protein faces

Reshma Kadam, FB04, O

Dual nature of Janus particles with tailored chemistries are applied as multifunctional cell surface targets. We present a model system for scalable preparation of Janus NPs with dual proteins, using wax Pickering emulsion technique. 80 nm azido SiNPs, are used to prepare wax water Pickering emulsions, for click chemistry of ferritin. They are subjected to biotin-ethoxy silane, to bind streptavidin. The results show the scalable method to prepare Janus NPs with dual protein functionalities.

L5 Prediction of fibre orientation in injection moulded polymers reinforced with recycled carbon fibres

Katharina Albrecht, Hochschule Bremen - Fakultät 5 - Bionik

Due to growing demands for carbon fibres (CFs), the development of recycling strategies becomes more important. Re-using rCFs in injection moulded polymers in the automobile industry has become promising. Therefore, numerical simulations are essential. A primary objective is to predict the fibre orientation in the component. The poster presents necessary steps to determine fibre interaction coefficients for rCFs-reinforced polymers to implement them in commercial injection moulding simulations.

10:30 Coffee break

Session 2

11:00 High -Throughput Exploration of Evolutionary Structural Materials

Nils Ellendt, FB04, IWT Bremen

While high-throughput experimental and computational methods exist for the development of functional materials, structural materials are still being developed on the base of experience, stepwise prediction and punctual support of computational models. As a result, many major breakthroughs have been and still are achieved by coincidence under non-intuitive conditions. Experimental high throughput methods allow to explore large process windows where no prediction is possible due to lack of existent data. We propose the high throughput method "Farbige Zustände" as a novel approach for the experimental exploration of structural materials. New methods for sample synthesis, treatment and characterization are developed as well as computational methods for ad-hoc data analysis, search and experiment planning.

11.30 Lightning Presentations

L6 Advanced Processing of Zinc Sulfide (ZnS) for Ultra-efficient Materials to be Implemented into Displays

Magdalena Thode, FB01, ZARM

Displays consume tremendous amounts of power. This has led to the reinvestigation of electroluminescent materials. There is much potential in improving electroluminescent properties of ZnS doped materials with advanced processing: synthesis via self-propagating high-temperature synthesis under variable gravity conditions, shock processing, and Plasmon enhancement. Quantifications in the crystal structures are explored to further the unique structure-property-performance relationships.

L7 Electrohydraulic forming

Holger Pegel, FB04, bime

This research is about electrohydraulic forming due to an underwater electric wire explosion. An aluminum wire is mounted in a fluid filled pressure chamber. In the process the wire is exposed to a high voltage respectively high current electric pulse to achieve an instant vaporization. This leads to a volume expansion and a plasma in the chamber. The expansion creates a fast increase of pressure resulting in a shock wave which is transferred by the fluid and used to form metal sheets or tubes.

L8 Investigation of affected area of infeed rotary swaging

Yang Liu, FB04, bime

In rotary swaging process, just a part of material will be deformed, the rest of the workpiece experience nearly no deformation. To figure out the area and how this area affected by different processing parameters and how this area behaves is important to get a better understanding of the process. Also, to control the behavior of this area is helpful for the control of material flow in industry.

L9 Sequential method forming complex microstructures

Lasse Langstädtler, FB04, Bremen Institute for Mechanical Engineering

Conventional manufacturing free formed microstructures high precision machines as well as long manufacturing times are required. The main idea introduced here is to divide the conventional abrasive process into two sequential electromagnetic forming steps - 1st micro structuring and 2nd generating the macro geometry. As the process works contactless, the microstructures aren't damaged. Furthermore the forming tools are less complex and more flexible as well as the manufacturing time decreases.

L10 Internal material load analysis during mechanical processing with synchrotron radiation

Heiner Meyer, FB04, Institut für Werkstofftechnik

A method for non-destructive internal material load and residual stress analysis in materials during mechanical processing using synchrotron radiation is presented. The experimental setup as well as the determined strain distribution in the material is shown and an analytical concept for the effects of the process formulated.

Poster session & lunch

12:00 Poster session & lunch in the TAB

Session 3

14:00 Hercules – Higher European Research Course for Users of Large Experimental Systems

Andrea Kirsch, FB02

Nowadays, the use of neutron and synchrotron radiation in condensed matter studies is indispensable to answer difficult and complex questions arising in science. The experiments are often very unique and difficult and require the use of large experimental facilities. In this context, the international Hercules school is one of the most regarded schools worldwide to provide the users with the necessary knowledge to perform high quality experiments at a synchrotron or neutron source. The school has been held in Grenoble, France at the Institute Laue-Langevin (ILL) and the European Synchrotron Radiation Facility (ESRF) since 1991 and around 70 participants are yearly chosen by a scientific committee to absolve an intensive training for five weeks including lectures, practical courses, tutorials, the visit of large facilities and a poster session. Additionally, a seven days programme is included in a partner institution among European Large instruments, either at Desy (Germany), Elettra and Fermi (Italy), Soleil and LLB (France) or PSI (Switzerland). The lectures cover fundamentals in physics and chemistry, basic methods and instruments of synchrotron and neutron radiation as well as specialized topics in the application to physics, biology, engineering and chemistry of condensed matter. All the lectures are held by highly respected experts in their special fields.

14:30 Lightning Presentations

L11 Efficient, simultaneous vision ray calibration and system orientation for high precision geometric-optical 3D-measurement systems

Martin Prinzler, FB01, BIAS

Camera calibration is crucial for every image-taking measurement. Current methods are mainly based on the pin-hole-model, which has severe limitations. Vision ray calibration, a model developed at BIAS, provides precision and flexibility, but requires increased calibration efforts. In the DFG project Sichstrahl Plus we therefore investigate numerically efficient algorithms and elaborate recommendations for implementation.

L12 Plasma-assisted growth of VO₂ on TiO₂(110) and study of its chemical and structural properties

Simon Fischer, FB01, Institute of Solid State Physics

With VO₂ exhibiting a temperature-induced metal-insulator transition, thin film growth of this material is of interest for applications such as switching devices and sensors. In this study, we deposited vanadium on TiO₂ substrates while cyclically subjecting the samples to different doses of atomic oxygen from a plasma source. Film thickness and vanadium oxidation state are determined from XPS analysis, while LEED reveals different surface terminations.

L13 Can we see Non-nuclear Attractor from X-ray wave function refinement?

Rumpa Pal, FB02, Institute of Inorganic Chemistry and Crystallography

The chemistry of metal-metal bonding is a rapidly developing field. A non-nuclear attractor, NNA, has been observed in a stable molecular species of a central [Mg₂]²⁺ unit flanked by protective anion. In this study, X-ray wave function refinement has been used to explore the existence of NNA in molecular [Mg₂]²⁺ system.

L14 Analytical Method Development for Monitoring the Extraction of Natural Components using Spectroscopic Techniques

Anna Dittmar, FB04, Technische Thermodynamik

The development of methods to recover organic contaminants from wastewater is of high importance. In this work, UV-VIS and FTIR spectroscopy are used to measure organic contaminants present in aqueous systems to encourage the development of future process monitoring routines. Based on a model system of Vanillin, water and an Ionic Liquid as extraction agent, the accuracy of the methods as well as the quality, reliability and consistency of the analytical results are tested.

L15 In situ studies of transition metal dichalcogenides growth

Moritz Ewert, FB01, Institute of Solid State Physics

Transition metal dichalcogenides (TMDCs) exhibit graphene-like electronically properties, but, contrary to graphene, a sizable direct band gap, suggesting their use in novel transistors, emitters, or detectors. 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 MoS₂ islands under ultra-high vacuum conditions. Complementary structural and chemical information is obtained from X-ray photoelectron spectroscopy and scanning tunnelling microscopy measurements.

15:00 Coffee break

Session 4

15:30 Lightning Presentations

L16 Insight into the Mechanism of Reversible Ring-Opening of 1,3-Benzoxazine with Thiols

Tobias Urbaniak, FB02, Fraunhofer IFAM

Polymers based on reversible, covalent bonding have drawn increasing interest for the preparation of smart materials. The ring-opening reaction of benzoxazines with thiols has a great potential for this application. Our main objective is to study the reversible character of solvent-mediated and solvent-free reactions in order to gain insight into the reaction mechanism. We have found a way to influence and to control that reaction with a suitable combination of reactants and reaction conditions.

L17 Photocatalytic activity of nanoporous gold - zinc phthalocyanine hybrid materials

David Steinebrunner, FB02, IAPC

Photocatalysis is a powerful tool for the oxidation of various substrates under mild reaction conditions by just using visible light to drive the chemical reaction. For this purpose we are preparing and investigating a new class of photocatalysts, a nanoporous gold - zinc phthalocyanine hybrid material, which aims to exploit the optical properties of both materials and in addition combines the advantages of homogeneous and heterogeneous catalysis.

L18 Control of Ag residues in nanoporous gold

Anastasia Lackmann, FB02, Institute für Physikalische und Angewandte Chemie

Owing to its interconnected pores and ligaments of only a few tens of nanometers in size nanoporous gold (npAu) provides an extended strongly curved gold surface. Its application in catalysis depends critically on Ag residues after preparation making the Au surface locally less noble and reactive. We improved existing corrosion techniques of various AuAg alloys providing control over dissolution dynamics and Ag content of the catalyst samples.

L19 Silica: both friend and foe. Insights on nanotoxicity from simulations of silica-membranes interactions.

Massimo Delle Piane, FB04

Interaction of silica with biological systems is complex and contradictory: it is at the basis of many biomineralization processes and, at the same time, some forms of silica induce toxic effects at the cellular level. Silica behavior might be dependent on the interaction of the cell membrane with the silica particles' surface. We investigate this topic using all-atom MD simulations, coupled to techniques enabling a prediction of free energy profiles across the hybrid membrane-silica interface.

L20 Investigation of Li₇La₃Zr₂O₁₂-PEO composite electrolytes for solid-state batteries

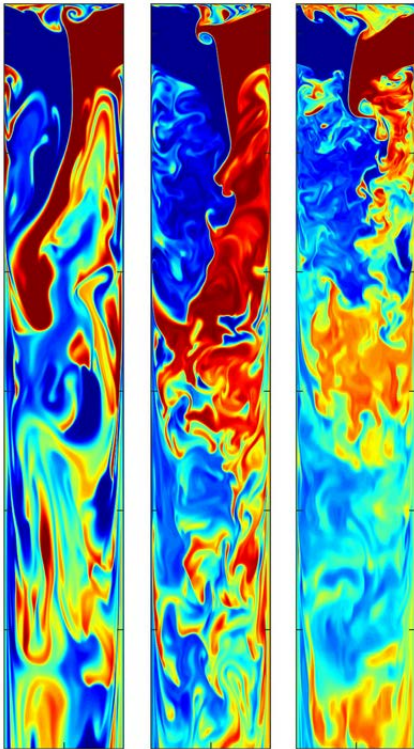
Frederieke Langer, FB04

Garnet crystal structure type Li₇La₃Zr₂O₁₂ (LLZO) and polymer electrolyte poly(ethylene oxide) (PEO) are investigated as electrolyte materials for solid-state batteries. The aim is a composite of both materials with high ionic conductivity. Here, model systems consisting of symmetrical polymer/LLZO/polymer layers are characterized using impedance spectroscopy with the aim to identify the lithium ion transition process across the ceramic/polymer interface.

16:00 Plenary lecture

Processes at fluid interfaces

Marc Avila, FB4, Zarm, Fluid Mechanics



Fluid interfaces are ubiquitous in engineering and their dynamics determines the efficiency of many processes. Depending on the nature of the interfaces, there are various mechanisms acting at different spatial and temporal scales. The theme of this talk will be their accurate modeling and the solution of the resulting equations with high-performance-computing codes. First, I will start with the dynamics of interfaces separating laminar from turbulent regions in single-phase flows. Our recent understanding of the underlying physical principles paves the way to reduce energy costs in transporting fluids through pipelines. Second, I will turn my attention to the precipitation of nano-particles occurring at the interface between two miscible fluids. Finally, I will focus on immiscible fluids and discuss the consistent modeling of processes in which the topology of the interfaces changes drastically as time evolves.

Poster session & dinner

- 17:00** Poster session & dinner in the TAB
- 18:00** Dinner buffet
- 18:30** Video clips

Social event

- 19:30** Travel to city centre (Tram 6 to Domsheide, 19:51)
- 20:30** Night Watchman City Tour (meet in front of the cathedral in the city centre)

Organizing committee

- Hanna Lührs**, MAPEX
- Susan Köppen**, FB4
- Sarah Schriefer**, MAPEX
- Ilona Bartkowski**, FB4, MAPEX

Notes ...

List of Participants

1. **Albrecht, Katharina**, FB04, Hochschule Bremen - Fakultät 5 - Bionik
2. **Aminian, Alieh**, FB04
3. **Avila, Marc**, FB04, ZARM
4. **Bartkowski, Ilona**, FB04, MAPEX
5. **Castillo, Martin**, FB04, ZARM
6. **Condi Mainardi, Jessica**, FB04, Advanced Ceramics
7. **Delle Piane, Massimo**, FB04, BCCMS
8. **Dittmar, Anna**, FB04, Technische Thermodynamik
9. **Dumstorff, Gerrit**, FB01, IMSAS
10. **Ellendt, Nils**, FB04, IWT Bremen
11. **Ewert, Moritz**, FB01, Institute of Solid State Physics
12. **Fischer, Simon**, FB01, Institute of Solid State Physics
13. **Groke, Holger**, FB01, IALB
14. **Haag, Katharina**, FB04, IFAM
15. **Haselsteiner, Andreas**, FB04, Institut für Integrated Product Development (BIK)
16. **Herrmann, Marius**, FB04, Bime
17. **Hoffmann, Ron**, FB02, Fraunhofer IFAM
18. **Jaschinski, Hannes**, MAPEX
19. **Kadam, Reshma**, FB04
20. **Kirsch, Andrea**, FB02, Institute of Inorganic Chemistry and Crystallography
21. **Köppen, Susan**, FB04, Bremen Centre for Computational Materials Science
22. **Lackmann, Anastasia**, FB02, Institute für Physikalische und Angewandte Chemie
23. **Langer, Frederieke**, FB04
24. **Langstädtler, Lasse**, FB04, Bremen Institute for Mechanical Engineering
25. **Lid, Steffen**, FB04, Bremen Centre for Computational Materials Science
26. **Liu, Yang**, FB04, bime
27. **Lührs, Hanna**, MAPEX
28. **M. Hoog Antink, Marieke**, FB04, Advanced Ceramics
29. **Maas, Michael**, FB04, Advanced Ceramics
30. **Meyer, Daniel**, FB04, IWT Bremen
31. **Meyer, Heiner**, FB04, Institut für Werkstofftechnik
32. **Ohlendorf, Jan-Hendrik**, FB04, Institut für integrierte Produktentwicklung (BIK)
33. **Pal, Rumpa**, FB02, Institute of Inorganic Chemistry and Crystallography
34. **Pegel, Holger**, FB04, Bime
35. **Prinzler, Martin**, FB01, BIAS
36. **Rievers, Benny**, FB04, ZARM
37. **Sakka, Yvonne**, FB02, UFT
38. **Schenck, Christian**, FB04, bime
39. **Schriefer, Sarah**, FB02, MAPEX
40. **Smits, Joeri**, FB04, Advanced Ceramics
41. **Stapelfeldt, Karsten**, FB01, Biophysik
42. **Steinebrunner, David**, FB02, IAPC
43. **Suter, Naiana**, FB01, Biophysik
44. **Tawfeeles, Andrew**, FB05
45. **Thode, Magdalena**, FB01, ZARM
46. **Urbaniak, Tobias**, FB02, Fraunhofer IFAM

4th 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 “lightning 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 Marc Avila, a newly appointed professor at the University of Bremen and director of the ZARM. After a day full of scientific insights, the day will close with a guided „night watchman city tour“.

The workshop is a good platform for you if you would like 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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