FOR5044 Periodic low-dimensional defect structures in polar oxides

Summer School 2023

Program

Wednesday, 06.09.2023

11:00 – 11:15 **Welcome**
Prof. Holger Fritze, TU Clausthal

11:15 – 12:45 **Theoretical foundations and modelling**

Focus: Macroscopics and phenomenology
- Polarization reversal
- Domains
- Nonlinear optics
- Polarons

Speaker:
Prof. Marco Bazzan, University of Padova

Focus: Theoretical approaches
- Atomistic Modeling
- Density Functional Theory
- Modelling solid solutions
- Theoretical Spectroscopy

Speaker:
Prof. Simone Sanna, Justus-Liebig-University Gießen

14:00 – 15:30 **Crystal growth and thin-film deposition**
Focus: Bulk crystals
- Phase diagram and melting behavior
- Growth techniques
- Distribution of constituents and dopants
- Interface stability and growth limitations

Speaker:
Dr. Steffen Ganschow, IKZ Berlin

Focus: Thin films
- Growth and in-situ characterization techniques
- Growth modes
- Homo-/heteroepitaxy
- Domain formation in strained films

Speaker:
Dr. Jutta Schwarzkopf, IKZ Berlin

16:00 – 17:30 **Poling and domain structures**
Focus: Domains and Domain Walls (DWs)
- How to identify and engineer ferroelectric *domains*?
  Techniques, Poling, Parameters, Resolution
- How to identify ferroelectric *DWs*?
  Methods, Parameters

- What “novel” properties do we expect from *DWs*? Conductivity, Potential Applications and Device

Speaker:
Dr. Michael Rüsing, TU Dresden

Thursday, 07.09.2023

08:30 – 12:00 Defects and atomistic transport

Focus: Polarons
- Pulse-induced charge carrier injection and detection
- Ballistic-coherent transport
- Self-localization of charge carriers
- 3D hopping transport
- Pinning and recombination mechanisms
- Volume photovoltaic current density

Speaker:
Prof. Mirco Imlau, Osnabrück University

Focus: Ion transport
- Basics of diffusion and point defects in solids
- Special features of ion transport in ionic crystals
- Defect chemistry
- $LiNbO_3$ and related materials
- Experimental methods of tracer diffusion

Speaker:
Prof. Harald Schmidt, TU Clausthal

Focus: Electrical conductivity and acoustic loss
- Fundamentals of acoustic loss in piezoelectric crystals
- Characterization methods
- Electrical conductivity of $LiNbO_3$-$LiTaO_3$
- High-temperature acoustic loss in LiNbo3-$LiTaO_3$

Speaker:
Prof. Holger Fritze, TU Clausthal

Focus: Thermal stability
- Growth-related defects in $Li(Nb,Ta)O_3$
- Vapor Transport Equilibration (VTE)
- Methods of Li-Stoichiometry evaluation in $Li(Nb,Ta)O_3$
- Optical absorption
- Influence of Li-stoichiometry on $Li(Nb,Ta)O_3$ properties

Speaker:
Dr. Yuriy Suhak, TU Clausthal

12:00 – 12:45 Applications

Focus: Sensors
- High-temperature piezoelectric materials
- Challenges and applications of force and pressure sensors

Speaker:
Dr. Roland Sommer, Kistler Instrumente AG

14:00 – 14:20 **Presentation of the IKZ**
Innovations in Crystalline Materials - Innovations by Crystalline Materials
Speaker:
Prof. Matthias Bickermann, IKZ Berlin

Friday, 08.09.2023

09:00 – 09:45 Innovations and promoting of young researcher
Speaker:
Dr. Christiane Richter, DFG

09:45 – 15:30 **Hands-on: Spectroscopy**
Czerny-Turner-Spectrograph; Interferometer for Fourier-Transform Spectroscopy, Line- and Point Detection systems, Principles of Optical Adjustments
Tutor:
Prof. Mirco Imlau

Hands-on: Modelling
Modelling electronic and optical properties of ferroelectric solid solutions within DFT
Tutor:
Prof. Simone Sanna