



# TCO2024

## Transparent Conductive Oxides – Fundamentals and Applications

Monday, 23 September to Friday, 27 September 2024  
Universität Leipzig, 04103 Leipzig, Linnéstr. 5,  
Lecture Hall for Theoretical Physics

### Agenda

#### Monday, 23 September 2024

13:00 Prof. Dr. Marius Grundmann  
Universität Leipzig, Germany  
*Opening*

#### Tutorials: Anisotropic Properties of Oxide Semiconductors

13:15 **Tutorial I**  
Prof. Dr. Marius Grundmann  
Universität Leipzig, Germany  
*Anisotropic elastic properties*

14:00 **Tutorial II**  
Prof. Dr. Saskia Fischer  
Humboldt-Universität zu Berlin, Germany  
*Anisotropy and size effects in thermal and  
thermo-electrical properties of  $\beta$ -Ga<sub>2</sub>O<sub>3</sub>*

14:45 **Tutorial III**  
Dr. Chris Sturm  
Universität Leipzig, Germany  
*Optical properties of optically anisotropic materials*

15:30 *Coffee break (Aula)*

\*Invited talk

°Keynote talk



### Session Topic: Wide Bandgap Materials for Solar Energy Harvesting

- 16:00 Prof. Luis Pereira (\*)  
Universidade Nova de Lisboa, Portugal  
*Oxide nanostructures on mechanical energy harvesting applications*
- 16:45 Dr. Frank Herklotz  
Technische Universität Dresden, Germany  
*The interstitial hydrogen donor in SnO<sub>2</sub>: A comprehensive spectroscopic study*
- 17:00 Dr. Dwight R. Acosta Najarro  
Universidad Nacional Autónoma de México, Mexico City, Mexico  
*Rejuvenation of electrochromic properties in rhenium doped WO<sub>3</sub> thin films deposited by pneumatic spray pyrolysis*
- 17:15 Dr. Lars Korte (\*)  
Helmholtz-Zentrum Berlin für Materialien und Energie, Germany  
*High efficiency perovskite/Si tandem solar cells: Challenges in materials and interface design*
- 19:00 Dinner for invited speakers ("Auerbachs Keller")

### Tuesday, 24 September 2024

- 10:00 *Excursion Museum of Fine Arts Leipzig - MdbK ([www.mdbk.de](http://www.mdbk.de))  
Venue: Katharinenstraße 10*
- 12:30 *Lunch (Aula)*

### Session Topic: Amorphous and off-stoichiometric TCOs

- 14:00 Prof. Julia Medvedeva (\*)  
University of Missouri, USA  
*Materials genome approach to defects in amorphous oxide semiconductors*
- 14:45 Dr. Takashi Koida  
National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan  
*Amorphous SnO<sub>2</sub> thin films with superior conductivity: Production methods, characterizations, and comparative analysis with amorphous In<sub>2</sub>O<sub>3</sub> thin films*

\*Invited talk

°Keynote talk



- 15:00 Chun Yuen Ho  
University of Southern Denmark, Sønderborg, Denmark  
*Defects evolution and upscaling of aluminum doped zinc oxide*
- 15:15 Dr. Andrey Zameshin  
Malvern Panalytical B.V., Almelo, The Netherlands  
*Thin films and wafer analysis with laboratory X-ray diffraction techniques*
- 15:30 *Coffee break (Aula)*
- 16:00 Prof. Dr. Bernd Szyszka (\*)  
Technische Universität Berlin, Germany  
*Current status of hollow cathode gas flow sputtering for advanced TCO films*
- 16:45 Alexander Creutz  
Technische Universität Darmstadt, Germany  
*Electrical properties of partially reactive co-sputtered  $\text{In}_2\text{O}_3$  thin films*
- 17:00 ***Karl Bädeker Lecture***  
Prof. Dr. Darrell Schlom  
Cornell University, Ithaca, USA  
*Navigating reaction pathways to grow TCOs by suboxide MBE*
- 18:00 Poster session and finger food (TA307)

### Wednesday, 25 September 2024

#### Session Topic: Ultra-wide Bandgap Materials

- 09:00 Dr. Alexander Karg (\*)  
Universität Bremen, Germany  
*MBE growth of  $\kappa\text{-Ga}_2\text{O}_3$ : From phase stabilization towards the realization of heterostructures*
- 09:45 Clemens Petersen  
Universität Leipzig, Germany  
*Structural properties of PLD-grown ternary alloys of rhombohedral transition metal sesquioxides and  $\alpha\text{-Ga}_2\text{O}_3$*

\*Invited talk

°Keynote talk



- 10:00 Martin Williams  
Universität Bremen, Germany  
*Growth, catalysis and faceting in  $\alpha$ -Ga<sub>2</sub>O<sub>3</sub> and  $\alpha$ -(In<sub>x</sub>Ga<sub>1-x</sub>)<sub>2</sub>O<sub>3</sub> on m-plane  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> by molecular beam epitaxy*
- 10:15 Dr. Javier García Fernández  
University of Oslo, Norway  
*Probing, microstructure, crystallization and phase segregation in (In<sub>1-x</sub>Ga<sub>x</sub>)<sub>2</sub>O<sub>3</sub> thin films by TEM*
- 10:30 *Coffee break (Aula)*
- 11:00 Prof. Piero Mazzolini (\*)  
University of Parma, Italy  
*Engineering shallow and deep level defects in  $\kappa$ -Ga<sub>2</sub>O<sub>3</sub> thin films: Comparing metal-organic vapour phase epitaxy to molecular beam epitaxy and the effect of annealing treatments*
- 11:45 Wenshan Chen  
Paul-Drude-Institut Berlin, Germany  
*Phase transitions of GeO<sub>2</sub> by in-situ solid phase epitaxy and ex-situ post-annealing*
- 12:00 *Lunch (Aula)*

**Session Topic: TCMs: Halide Semiconductors**

- 14:00 Prof. Monica Morales-Masis (\*)  
University of Twente, The Netherlands  
*Development and study of novel transparent conducting materials for solar cells*
- 14:45 Dr. Michael Seifert  
FSU Jena / Ruhr-Universität Bochum, Germany  
*Computational prediction and characterization of CuI-based ternary p-type transparent conductors*
- 15:00 Yang Chen  
Universität Leipzig, Germany  
*Heteroepitaxial growth of  $\gamma$ -CuI thin films deposited by PLD with modification of the conductivity*

\*Invited talk

°Keynote talk



- 15:15 Dr. Romain Claes (°)  
University of Birmingham, UK  
*Limits to hole mobility and doping in copper iodide*
- 15:45 Sandra Montag  
Universität Leipzig, Germany  
*Nonlinear bond length change in zincblende Cu(Br,I) alloys*
- 16:00 *Group photo shooting (in front of the main entrance)*  
*Coffee break (Aula)*

**Session Topic: Post-growth Annealing of Wide Bandgap Alloys**

- 16:30 Dr. Takuya Hosokai (\*)  
AIST, Japan  
*Real-time monitoring of the laser-induced functionalization of transparent conductive oxide films*
- 17:15 Dr. Jiri Rezek  
University of West Bohemia, Pilsen, Czech Republic  
*Enhancement of hole mobility in high-rate reactively sputtered CuO<sub>2</sub> thin films induced by high-power infrared laser*
- 17:30 Prof. Dr. Vassilios Binas (°)  
Aristotle University of Thessaloniki, Greece  
*Transparent conductive oxides for energy and electronic applications*
- 18:00 Dr. Ryotaro Nakazawa  
Institute for Molecular Science, Okazaki, Japan  
*In-gap states of an amorphous In-Ga-Zn-O<sub>4</sub> thin film studied via photoemission spectroscopies: Direct observation of light-induced in-gap states*
- 18:15 Dr. Thomas Dittrich  
Helmholtz Zentrum Berlin für Materialien und Energie GmbH, Berlin, Germany  
*Surface photovoltage spectroscopy of ultra-wide bandgap materials*
- 20:00 Prize ceremony and conference banquet at "Mückenschlösschen"

\*Invited talk

°Keynote talk



**Thursday, 26 September 2024**

**Session Topic: Local Structures and Interfaces**

- 09:00 Prof. Dr. Claudia S. Schnohr (°)  
Universität Leipzig, Germany  
*Short-range structure and amorphous nature of Zn-Sn-O and Cu-Sn-O semiconductor thin films*
- 09:30 Peter Callaghan  
Trinity College Dublin, Ireland  
*Investigating the local bonding structure of amorphous zinc tin oxide to elucidate the effect of altering the intercation ratio*
- 09:45 Dr. Ramon Schifano  
Polish Academy of Sciences, Warsaw, Poland  
*Branch point energies in ZnO and MgO measured using ZnMgO:Al/Si heterostructures*
- 10:00 Dr. Elzbieta Guziewicz  
Polish Academy of Sciences, Warsaw, Poland  
*Acceptor and donor states in N-doped ZnO films: Effect of strain and surface proximity*
- 10:15 *Coffee break (Aula)*

**Session Topic: UWBG-based Devices**

- 10:45 Dr. Andrew Green (\*)  
Air Force Research Laboratory, USA  
*Gallium oxide microelectronics*
- 11:30 Dr. Sofie Vogt (°)  
Universität Leipzig, Germany  
*High performance metal-semiconductor field-effect transistors on zirconium doped  $\alpha$ -Ga<sub>2</sub>O<sub>3</sub>*
- 12:00 *Lunch (Aula)*

\*Invited talk

°Keynote talk



**Session Topic: Polymorphism in UWBG Semiconductors**

- 14:00 Prof. Dr. Markus Wagner (°)  
Paul-Drude-Institut Berlin, Germany  
*Anisotropy of optical transitions and thermal transport in Ga<sub>2</sub>O<sub>3</sub> polymorphs*
- 14:30 Mustafa Göktürk Yazlak  
Universität Leipzig, Germany  
*Revealing the incorporation site and local structure of nickel and selenium in doped Cul thin films using X-ray absorption spectroscopy*
- 14:45 Christiane Dethloff  
Universität Leipzig, Germany  
*Eliminating oxygen in-diffusion into Cul thin films and cappings through area-selective magnetron co-sputtering*
- 15:00 Prof. Yasushi Hirose (\*)  
Tokyo Metropolitan University, Japan  
*Rutile SnO<sub>2</sub>-GeO<sub>2</sub> alloy-based deep ultraviolet-transparent conducting films*
- 15:45 *Coffee break (Aula)*

**Session Topic: Advanced Aspects of Solar Cell and Wide Bandgap Materials**

- 16:15 Prof. Dr. Wolfgang Tress (\*)  
Zürcher Hochschule für Angewandte Wissenschaften, Switzerland  
*Characterizing perovskite optoelectronic devices*
- 17:00 Dr. Thorsten Schultz (°)  
Technische Universität Berlin, Germany  
*X-ray photoelectron spectroscopy – a versatile characterization tool for transparent conducting oxides*

**Friday, 27 September 2024**

**Session Topic: Multinary Wide Bandgap Materials**

- 09:00 Prof. Dr. Janine George (\*)  
Bundesanstalt für Materialforschung und -prüfung, Berlin, Germany  
*High-throughput approaches for materials understanding and design*

\*Invited talk

°Keynote talk



- 09:45 Jorrit Bredow  
Universität Leipzig, Germany  
*Towards synthesis of compositionally graded multi-component oxide thin films by CCS-PLD using multi-segmented targets*
- 10:00 Minseok Kim  
Aoyama Gakuin University, Sagamihara, Japan  
*Independent control of the valence band maximum and conduction band minimum of amorphous Cd–In–Ga–O thin film by adjustment of Cd and Ga concentration*
- 10:15 Dr. Karsten Fleischer  
Dublin City University, Ireland  
*Complex growth kinematics in spray pyrolysis grown ternary transparent conducting oxides*
- 10:30 Daichi Miyagi  
Aoyama Gakuin University, Sagamihara, Japan  
*p-type Cu<sub>2</sub>O films deposited by RF sputtering using Cu or Cu<sub>2</sub>O targets*
- 10:45 *Coffee break (Aula)*
- 11:15 Dr. Jonas Deuermeier (\*)  
Universidade Nova de Lisboa, Portugal  
*ZTO-based memristors and diodes for neuromorphic computation*
- 12:00 Shiun Inoue  
Chiba University, Chiba, Japan  
*Observation of in-gap states in Cu<sub>2</sub>O thin films using constant initial and final states yield spectroscopy*
- 12:15 Dr. Brian Walls  
Trinity College Dublin, Ireland  
*Crystallographic structure and electrical and optical properties of V<sub>2</sub>O<sub>3</sub> - Cu<sub>2</sub>O bilayers*
- 12:30 Prof. Dr. Marius Grundmann  
Universität Leipzig, Germany  
*Closing*
- 12:40 Prospective end

\*Invited talk

°Keynote talk