

# IGK 2495 Yearly School

## Tutorials & Hands-on Workshops

### 25 - 26 January 2024

As part of the collaboration between FAU and Nagoya Institute of Technology, Japan, the International Research Training Group IGK2495 organizes Tutorials and Hands-on Workshops in January 2024. Tutorials will be held by Principal Investigators as short-courses on various specific topics of importance to energy systems. Hands-on Workshops will be held by doctoral researchers and be offered in conjunction with the tutorials, where participants can directly use the learned material of the tutorial. In addition to our IGK2495 members, master students are also welcome to register for the tutorials and hands-on workshops.

Registration here: —**STUDON**—

### Day 1, 25 January 2024

#### Tutorials

##### Depositing Thick Films with Aerosol Deposition

Prof. Dr. Kyle G. Webber



Powder aerosol deposition is a state-of-the-art room temperature method for making thick films. Participants in this tutorial will gain an insight into the deposition mechanisms, process limitations, and future research directions.

Time: 09:00-11:00

Location: Room 0.02-142, Martensstr. 5a, Erlangen

##### Structure-Property Relationships of Perovskites

Dr. Neamul Hayet Khansur



This tutorial covers the basic of diffraction techniques and advanced data analysis methods for perovskites. Participants will gain an understanding of what can be investigated using x-ray diffraction as well as the advantages and limitations.

Time: 09:00-11:00

Location: Room 0.56, Martensstr. 5, Erlangen

##### Phase Field Modeling

Dr. Frank Wendler



Participants will be introduced to phase field modeling, including the advantages and limitations of thermodynamical models. The concept of Landau Theory will be discussed and prototypical material models will be presented for perovskites.

Time: 09:00-11:00

Location: Room 2.028-1, Dr. Mack-Str. 77, Fürth

#### Hands-on Workshops

##### Development of Thick Films

During this hands-on-workshop participants will be able to deposit their own films from beginning to end, seeing how one starts from dry powder and ends up with a dense film. Various parameters will be adjusted to observe their impact on the final film quality.

Time: 12:30-16:00

Location: Technical Hall (0.52), Martensstr. 5, Erlangen

##### X-Ray Diffraction of Perovskites

Participants will use a state-of-the-art x-ray diffractometer to characterize perovskite ferroelectrics at room temperature. Subsequently, the data will be analyzed as a group, helping participants understand various aspects of XRD.

Time: 12:30-16:00

Location: Room 0.56/XRD, Martensstr. 5, Erlangen

##### Phase Field Modeling using COMSOL

Participants will use a simple ferroelectrics material model in COMSOL to investigate the effects of various external fields and parameters on the domain structure. This will give participants practical experience in understanding various factors, like interaction energies and spontaneous polarization on perovskites.

Time: 12:30-16:00

Location: Room 2.209, Dr. Mack-Str. 77, Fürth



Energy Conversion  
Systems  
IGK 2495



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**Day 2, 26 January 2024**

#### Tutorials

##### Semiconductor Wafer Characterization

Prof. Dr. Peter Wellmann



This tutorial covers characterization methods for the determination of electrical and optical properties of semiconductor wafers. We will discuss the physical basis of the methods as well as their concrete application for high throughput characterization.

Time: 12:00-13:30

Location: Room 371, Martensstr. 7, Erlangen

##### Lead-Free Photovoltaics

Prof. Dr. Christoph Brabec



Participants will be introduced to the basics of photovoltaic devices, including the working principles, current state-of-the-art designs, and future directions. Here, the role of photo-electro-mechanical materials will be discussed in terms of potential multimodal energy generation.

Time: 10:00-12:00

Location: Room 371, Martensstr. 7, Erlangen

##### Finite Element Approaches to Coupled Problems

Prof. Dr. Paul Steinmann



The basic concepts of finite element approaches to problems coupling mechanical with other physical fields will be introduced and appropriate discretisation and solution techniques together with their implementations will be discussed. The participants will gain a basic understanding of coupled finite element technology to enable critically assessment of computational approaches in the literature.

Time: 10:00-12:00

Location: KTmfk seminar room, Paul-Gordan-Str. 3, Erlangen

#### Hands-on Workshops

##### Application of optical absorption mapping to determine charge carrier concentration in inorganic semiconductors

The participants will apply optical absorption mapping using light in the visible spectral range to determine the lateral distribution of charge carrier concentration in n-type and p-type doped SiC and GaAs semiconductor wafers. They will gain an understanding of how optical transitions in semiconductors can be used as a fingerprint to extract the dopant distribution.

Time: 13:30-17:00

Location: WW6 Lab room, Martensstr. 7, Erlangen

##### Characterizing Photovoltaic Cells

In this hands-on workshop, participants will characterize the band gap of various photo active perovskites as well as a photovoltaic cell. This will give participants an overview of how such measurements are performed.

Time: 13:30-17:00

Location: HIERN seminar room, Immerwahrstr. 2, Erlangen

##### Finite Element Approaches to Coupled Problems

We will computationally analyze simple coupled model problems using Abaqus and/or Matlab to investigate the effects of different discretizations, parameters, and simulation types on the results. This will render hands-on experience in understanding the coupling between the mechanical and electrical field as well as benefits and pitfalls when applying the finite element method.

Time: 13:30-17:00

Location: CIP-Pool MB 2, Konrad-Zuse-Str. 3, Erlangen