

Masterthesis

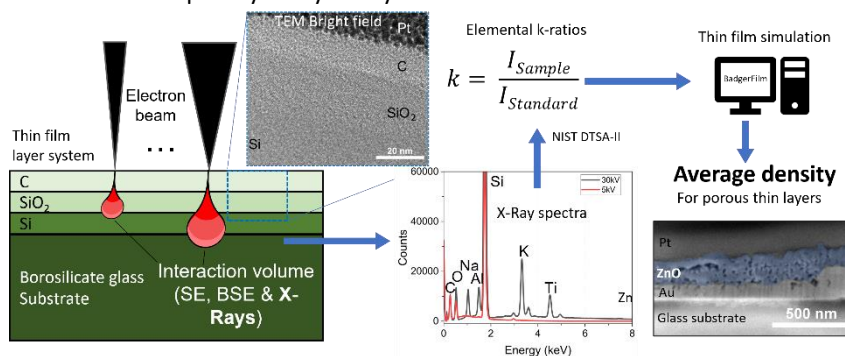
Electron Probe X-Ray microanalysis of Porous Thin Flms in Multi-Layer systems

Motivation

Printed electronics-based devices such as memristors enable opportunities as new data storage solutions. The analysis of such structures at the nanometer scale is enabled by electron probe x-ray microanalysis including energy dispersive X-ray spectroscopy (EDX). In combination of recorded EDX spectra and thin film simulations, key parameters such as layer thicknesses, chemical composition, and densities of individual thin film layers can be determined.

The goal of this thesis, is to estimate the porosity of ZnO in inkjet printed memristors using scanning electron microscope (SEM). The results are cross validated by focused ion beam (FIB)-SEM tomography.

Multi-layer systems are investigated using state-of-the-art electron microscopy (EM) techniques including SEM, high-resolution transmission electron microscopy (HRTEM), and scanning transmission electron microscopy (STEM). EDX spectra of the multi-layer system as well as reference samples (containing elements in the multi-layer system) are acquired. Spectra's are processed with hyperspy. The layer density is determined with thin film simulation software BadgerFilm. To validate the layer thicknesses, a TEM lamella is prepared by in situ lift-out using FIB-SEM and subsequently analyzed by TEM.



Tasks

Workflow for determining apparent density of porous thin layer

- Familiarization with electron microscope (SEM, TEM) and FIB (Focus Ion Beam) sample preparation technique
- Acquiring EDX Spectra of multi-layer system and reference samples
- Performing simulation and estimating densities
- Corss validation with FIB-SEM tomography

Timeline

- 1st-2nd month: literature review
- 3rd-5th month: SEM & TEM introduction + performing experiments
- 6th-7th month: analyzing results and thesis writing

Research area:

Electron Probe X-Ray Microanalysis, Simulation, Electron Microscopy

What you will learn:

Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Focused Ion Beam (FIB), Thin Layer Simulation

What you bring:

Master student in materials science or bachelor/master student in physics, basic knowledge in solid state and quantum physics

Starting date:

Beginning of 2026

Language:

English or German

Contact:

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