

Kolloquium

Am Mittwoch, den **04. Dezember 2019**, um **14:00 Uhr** hält

Dr. Alexander Tselev,
Department of Physics & CICECO–Aveiro Institute of Materials,
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einen Vortrag zum Thema

Subsurface Imaging with Near-Field Microwave Microscopy: Applications to Ferroelectrics and Trough-Membrane Characterization in Fluids

Der Vortrag findet in A1 3-330 statt.

Abstract:

Near-field microwave microscopy is an imaging and measurement tool exploiting reflection of GHz-frequency microwaves from a sharp scanning probe in contact with or in the vicinity of an object. Dependence of the microwave reflection on material properties allows non-destructive mapping and quantitative characterization of dielectric permittivity and conductivity with a spatial resolution as high as ~50 nm. The technique is versatile and can be applied to nanometer scale investigations of solids as well as liquids. In this talk, we illustrate the power of this technique in applications to ferroelectric thin films and in-situ imaging of processes in fluids. Using the microwave microscopy, we found that spontaneous and recorded domain walls in thin films of ferroelectric complex oxides $\text{Pb}(\text{Zr}_{0.2}\text{Ti}_{0.8})\text{O}_3$ and BiFeO_3 exhibit large conductance at GHz frequencies being nearly insulating at dc. We will discuss possible physical mechanisms behind the observed responses and how the effect can be further applied. We will also illustrate how simultaneous detection of piezo- and microwave responses separates relaxations of polarization and injected charges in scanning probe measurement of ferroelectrics. Further, we will demonstrate imaging capability of the technique with in-situ, through-membrane, imaging of dendrite formation near electrodes in a liquid electrolyte, etching of carbon fibers by an active plasma in real time, and probing of ionic liquids through single-layer graphene membranes.

Dr. Alexander Tselev obtained his M.S. degree in Radiophysics (Electrodynamics and Plasma Physics) from Nizhny Novgorod State University, Russia, in 1991 and Ph.D. degree in Materials Science and Engineering from Dresden University of Technology, Germany, in 2000. In 2001, he joined the University of Maryland, College Park, USA, as a postdoctoral researcher to work on the near-field microwave microscopy. From 2003 to 2009, he worked on physics of carbon nanotube devices and high-frequency conduction of carbon nanotubes at Georgetown University and Duke University in the USA. From 2009 to 2016, he was a Joint Faculty Research Assistance Professor at the University of Tennessee and the Oak Ridge National Laboratory, USA, where he made, in particular, multiple contributions in scanning probe microscopy techniques, including scanning tunneling microscopy, near-field microwave microscopy, and piezoresponse force microscopy. Starting 2016, he is a Principal Researcher at the Department of Physics and CICECO at the University of Aveiro in Portugal. His current research interests include physics, applications, and development of various SPM modalities, thermoelectric and electrocaloric materials, as well as materials for energy storage.

Eingeladen von: Prof. Dr.-Ing. habil. Sergej Fatikow

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