PURDUE UNIVERSITY

Birck Nanotechnology Center

neaSCOPE for Nanoscale Optical Material Characterization with 10 nm Spatial Resolution and 10 fs Temporal Resolution - Technology and Applications

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Abstract:

Every scientific question has its own merits and demands specific instrumentation to search for answers. Nanoscale IR is a new versatile technology which allows to probe material properties such as chemical composition, molecular orientation, stress & strain fields, and free- carrier concentration with 10 nm spatial resolution.
Nanoscale IR combines and exploits the benefits of two well established technologies, Atomic Force Microscopy (AFM) and Infrared microscopy and spectroscopy. An IR laser beam is focused on the apex of an AFM tip creating a nano-sized optical probe at the tip-sample interface. Acting as a local probe, the AFM tip senses the optical tip-sample interaction. By detecting either the scattered light from the area right below the tip (nano-FTIR) or by detection of the cantilever deflection and dynamics (tapping AFM-IR+) infrared images and spectra with nanoscale spatial resolution are obtained. Depending on the individual research needs, it is also possible to opt for VIS, IR or THz light sources.
Pushing the limits of nano-FTIR further and combining it with time-resolved pump-probe spectroscopy it is now even possible to measure the ultrafast charge-carrier dynamics in layered materials, semiconductors and strongly-correlated materials with femtosecond temporal and nanometer spatial resolution.
In our presentation, we will explain the basic working principle of nanoscale infrared microscopy modalities available for the neaSCOPE and will highlight the broad spectrum of applications for various material classes such as polymers, minerals, 2D and layered materials, semiconductors, photonic as well as novel photovoltaic and battery materials.

Bio:

Dr. Tobias Gokus finished his Diploma at University Siegen and Tuebingen working on single molecule/particle optical microscopy and spectroscopy of individual carbon nanotubes. For his PhD he joined the group of Prof. Achim Hartschuh at LMU, Munich for developing dedicated confocal and near-field optical microscopes optimized for studying the luminescence properties of low dimensional carbon materials. Captivated by the possibility to introduce the huge application potential of infrared near-field microscopy to a broader scientific community Tobias joined the nanoscale analytics department (ALX) of attocube systems AG as application engineer. In his current position he is exploring together with researchers in academia and industry new applications of near-field microscopy for their research.

Hosts: Professor Xianfan Xu: xxu@ecn.purdue.edu and Professor Thomas Beechem: tbeechem@purdue.edu