

Advances in imaging and quantification of electrical properties at the nanoscale using Scanning Microwave Impedance Microscopy (sMIM)

Understanding and optimizing advanced materials frequently requires detailed knowledge of nanoscale electrical properties. Scanning probe techniques such as scanning tunneling microscopy (STM), conductive AFM (cAFM), scanning capacitance microscopy (SCM), and Kelvin probe force microscopy (KPFM) provide such nano-electrical measurements, but are generally limited in the classes of materials they can characterize or the properties they can measure. Scanning microwave impedance microscopy (sMIM) uses GHz frequency microwaves and shielded AFM probes to directly measure the impedance (capacitance and conductance) of the tip sample interface. As such sMIM is sensitive to the permittivity and conductivity of a wide variety of samples including dielectrics, conductors, and semiconductors.

After introducing the theory of operation, we will review the state of the art, including high resolution imaging of electrical properties of quantum structures and 2D materials and devices. Additionally, we will present research on quantification of dielectric properties and semiconductor doping concentration, including nanoscale capacitance-voltage curves. Research results obtained at cryogenic temperatures and high field will also be discussed.

Speaker Bio: **Oskar Amster, M.S. (Sr. Dir. Marketing of PrimeNano, Inc)**

Mr. Amster has a background in Physics and Materials engineering with a focus on microelectronics processing. He has 20 years experience working with analytical instruments and metrology tools. His background is in applications development, strategic marketing, and product development. He has extensive experience working in Atomic Force Microscopy, Stylus Profilers, and Optical Profiler instruments. Prior to joining PrimeNano, Inc, Oskar was at KLA-Tencor and also held positions at several start-ups as well as mature instrument companies. He holds an MS in Materials Engineering and BS in Physics from Cal Poly San Luis Obispo.