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UCSD NANOENGINEERING SEMINAR

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Seminar Presentation: 2:00pm – 3:00pm

Cymer Conference Center

Is There Still More to Atomic Force Microscopy? Novel SPM Techniques for Cellular, Electronic and Optical Imaging

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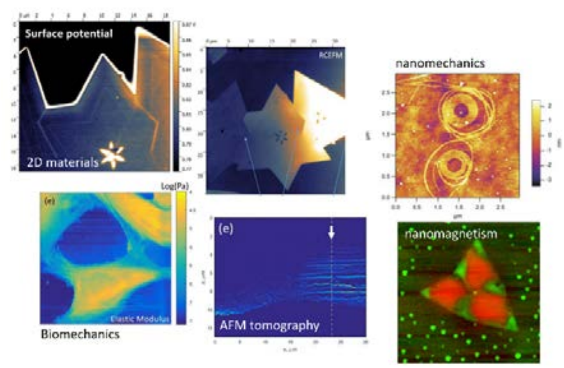
Abstract:



Scanning probe microscopy (SPM) has been one of the driving forces of nanotechnology and materials science. Over the last three decades, a large variety of SPM techniques have been developed to address imaging of form, structure and properties of micro and nanoscale materials. Despite the availability huge diversity of techniques, here we show that there is still need and opportunity for developing novel approaches using the Atomic Force Microscope. Particularly, we report development of antifouling Atomic force microscopy (AFM) tips for imaging and nanomechanical characterization of biological samples in fluid. The antifouling tips enable stable high speed imaging of live cells for prolonged durations with no visible damage to the cell vitality. Images taken at speeds of 100 µm/s scan speed at 4 Hz line frequency allow observation of moving organelles in image sequences captured on Rat Mesenchymal Stem Cells. Initial results show the potential of the tips for 3D imaging of cells. Using antifouling tips, we demonstrate a new nanomechanical mapping approach that allows rapid characterization, namely double-pass force distance mapping, where the topography information is captured in the first pass and nanomechanical characterization is performed in the second pass. For electrical characterization, we discuss frequency mixing based electrostatic imaging that provides higher resolution and suppressed background electrical potential mapping. Also a sample modulated surface potential technique is demonstrated for mapping conductivity of 2D materials. Applications to imaging and characterization of oxidative effects in grain boundaries of WSe_2 are presented. As the third novel technique, we describe modified magnetic force microscopy and magnetic characterization of few monolayer magnetic materials. The examples demonstrate the versatility of the AFM and its continuing potential for development.

Biosketch:

Aykutlu Dana received his PhD in Electrical Engineering, Stanford University 2003, under supervision of Prof. Yoshihisa Yamamoto and co-adviser Prof. Calvin Quate. He has been at Bilkent University since 2004, where he served as a part of the core team in the establishment of the first National Nanotechnology Center in Turkey. His research focuses on imaging, characterization and device applications of nanostructures in the context of nanophotonics, plasmonics, charge storage memory devices and sensors.