

Mechanical Engineering

Seminar

Host: Tyrone Porter

From Single Atoms to Sliding Nanoparticles: Scanning Probe Microscopes Get to the Point



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Mehmet Z. Baykara is an Assistant Professor at the Department of Mechanical Engineering and UNAM-Institute of Materials Science & Nanotechnology at Bilkent University in Ankara, Turkey, where he has initiated the Scanning Probe Microscopy (SPM) Research Group in Fall 2012 and is conducting research funded by the European Commission and TUBITAK.

He has obtained his B.S. degree in Mechanical Engineering from Boğaziçi University in Istanbul, Turkey with high honors in 2006, and his Ph.D. degree from the Department of Mechanical Engineering & Materials Science at Yale University in 2012. His doctoral work on atomic-resolution measurement of chemical interactions using advanced atomic force microscopy techniques has been recognized by the Materials Research Society (MRS) and the American Vacuum Society (AVS) through graduate student awards, and the associated thesis received the 2012 Henry Prentiss Becton Graduate Award for Exceptional Achievement in Research at Yale University.

Dr. Baykara has co-authored publications in journals such as ACS Nano, Advanced Materials and Nature Nanotechnology and has delivered numerous invited presentations at research institutes and universities around the world. Dr. Baykara is the recipient of the "2013 METU Parlar Foundation Research Incentive Award", the "2014 FABED Eser Tümen Outstanding Young Scientist Award" and the "2014 Outstanding Young Scientist Award of the Turkish Academy of Sciences (TÜBA-GEBİP)". He is a member of APS, AVS and MRS. Dr. Baykara is currently acting as a guest editor at the Beilstein Journal of Nanotechnology and is a member of the executive committee of the Nanometer-Scale Science and Technology Division of the American Vacuum Society (AVS-NSTD).

11 AM Friday, November 14th
Room 245, 110 Cummington Mall
Refreshments served at 10:45 AM

Since their invention three decades ago, scanning probe microscopes (SPM) have played a major role in defining the frontiers of nanometer scale research in fields as diverse as mechanics, catalysis and energy, among others. In this talk, we will first describe the state of the art in SPM-based research aimed at the quantification of atomic-scale chemical interactions on surfaces, by presenting

atomic resolution interaction maps obtained via the method of three-dimensional atomic force microscopy (3D-AFM) on surface-oxidized copper (Cu(100)-O). Important aspects to be discussed include (i) the quantification of differences in interaction forces exhibited by individual O atoms on the surface as well as (ii) the structural identification of atomic-scale, two-dimensional defects via combined atomic force microscopy/scanning tunneling microscopy (AFM/STM) imaging. In the second part of the talk, utilizing a large dataset of STM images obtained at various experimental settings on the same sample system, efforts aimed at uncovering the details of complex STM contrast formation mechanisms on metal oxides will be presented. Finally, by switching from the length scale of single atoms to nanoparticles of hundreds of nanometers, the talk will conclude with a summary of recent efforts directed towards the establishment of fundamental principles in nanometer-scale friction based on AFM-based manipulation of amorphous and crystalline nanoparticles on graphite substrates.

