UCLA Samueli
Materials Science & Engineering

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WHERE *FLATLANDS* MEET: MECHANICS AND ELECTRONICS AT ATOMICALLY FLAT INTERFACES

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Interfaces formed between material surfaces hold tremendous importance for a wide range of scientific disciplines, including but not limited to vast fields such as mechanics and electronics. Related phenomena are strongly influenced by the topographical roughness of the involved surfaces; as such, surprising behavior may emerge when both material surfaces forming an interface are ultimately (i.e. *atomically*) flat.

In this talk, we will present results of atomic force microscopy (AFM) experiments from our lab, focusing in particular on friction and electrical contact resistance (ECR) at atomically flat interfaces formed between nanoislands of noble metals and graphite. In particular, we demonstrate the remarkable occurrence of *structural superlubricity* (a state of ultra-low friction theoretically expected at molecularly clean and atomically flat, incommensurate interfaces) [1] at such interfaces under ambient conditions [2, 3]. Moreover, we present the first measurements of ECR as a function of *true* contact size by way of conductive AFM experiments performed at atomically flat gold-graphite interfaces [4]. The talk concludes with an overview of remaining challenges and emerging opportunities for both research directions.

[1] M.Z. Baykara, M.R. Vazirisereshk, A. Martini, *Applied Physics Reviews* **5**, 041102 (2018).
[2] E. Cihan, S. Ipek, E. Durgun, M.Z. Baykara, *Nature Communications* **7**, 12055 (2016).
[3] A. Özoğul, S. Ipek, E. Durgun, M.Z. Baykara, *Applied Physics Letters* **111**, 211602 (2017).
[4] M.R Vazirisereshk, S.A. Sumaiya, A. Martini, M.Z. Baykara, *Applied Physics Letters* **115**, 091602 (2019).

Dr. Mehmet Baykara obtained his B.S. degree in Mechanical Engineering from Boğaziçi University in Istanbul, Turkey in 2006, and his Ph.D. degree from the Department of Mechanical Engineering & Materials Science at Yale University in 2012. His doctoral thesis was recognized by the "*Henry Prentiss Becton Graduate Award for Exceptional Achievement in Research*" at Yale University. Between 2012 and 2017, Dr. Baykara worked as an Assistant Professor at Bilkent University, where he conducted research funded by the European Commission. During that time, he held visiting scholar positions at Columbia University and Harvard University. At the beginning of 2018, Dr. Baykara moved to the Department of Mechanical Engineering at the University of California Merced, to start a new faculty position.

Dr. Baykara authored publications in journals including *Nature Communications* and *Nature Nanotechnology*, and delivered numerous invited presentations at research institutes and universities around the world. He is the recipient of multiple academic awards, including those from the American Vacuum Society (AVS), Materials Research Society (MRS) and the German Physical Society (DPG).

LIGHT REFRESHMENTS WILL BE PROVIDED.