Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Interfacial charge dynamics studied by ultrafast electron diffraction[1] RYAN MURDICK, RAMANIKALYAN RAMAN, Michigan State University, YOSHIE MUROOKA, Osaka University, RICHARD WORHATCH, CHONG-YU RUAN, Michigan State University — Of central importance to nanoscale device technology is the role of charge transfer at interfaces. Using ultrafast electron diffraction, which has recently emerged as a new technique in determining transient surface photovoltages with nanometer sensitivity (Murdick et al., PRB 77, 245329, 2008), we investigate the surface charge and space-charge dynamics at the Si/SiO2 interface. By varying the excitation wavelength, fluence, and pulse duration, we explore various pathways inducing electron tunneling through an insulating barrier to reach the surface states. We show that the surface states have relatively long lifetimes (∼100 ps), but are rechargeable, thus ideal for serving as a charge pump for interfacial devices. Using the Si/SiO2 platform, we extend this diffractive potentiometry approach to study nanoparticle charging and molecular transport.

[1]This work was supported by the Department of Energy under Grant No. DE-FG02-06ER46309 and the ACS Petroleum Research Fund under Grant No. 45982-G10.

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Date submitted: 23 Nov 2008 Electronic form version 1.4