Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Nanoscale Structural Evolution of Electrically Driven Insulator to Metal Transition in Vanadium Dioxide GREG STONE, Department of Materials Science and Engineering, Pennsylvania State University, EUGENE FREEMAN, NIKHIL SHUKLA, Department of Electrical Engineering, Pennsylvania State University, HANJONG PAIK, Department of Materials Science and Engineering, Cornell University, JARRETT MOYER, Department of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois , ZHONGHOU CAI, HAIDAN WEN, Advanced Photon Source, Argonne National Laboratory, ROMAN ENGEL-HERBERT, Department of Materials Science and Engineering, Pennsylvania State University, DARRELL SCHLOM, Department of Materials Science and Engineering, Cornell University, VENKATRAMAN GOPALAN, Department of Materials Science and Engineering, Pennsylvania State University, SUMAN DATTA, Department of Electrical Engineering, Pennsylvania State University — We report the evolution of local structural of tensile strained vanadium dioxide thin films during an electrically driven insulator to metal transition by nanoscale hard X-ray diffraction. Evaluation of the Bragg diffraction intensity reveals a narrow metallic filament with rutile structure to be the dominant conduction pathway for the electrically driven insulator to metal transition, while the remainder of the channel area remained the monoclinic M1 phase. The filament dimensions were estimated using simultaneous electrical probing and nanoscale X-ray diffraction measurements. Analysis revealed that the width of the conducting channel can be tuned externally using resistive loads in series allowing for the manipulation of the M1/R phase ratio in the phase coexistence regime.

Greg Stone
Pennsylvania State University

Date submitted: 09 Nov 2013

Electronic form version 1.4