Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Nanoscale Electrical Imaging of Metal-Insulator Transition in Ion-Gel Gated ZnO Field Effect Transistors YUAN REN, Department of Physics, University of Texas at Austin, HONGTAO YUAN, Geballe Laboratory for Advanced Materials, Stanford University, XIAOYU WU, Department of Physics, University of Texas at Austin, YOSHIHIRO IWASA, Quantum-Phase Electronics Center and Department of Applied Physics, University of Tokyo, YI CUI, HAROLD HWANG, Geballe Laboratory for Advanced Materials, Stanford University, KEJI LAI, Department of Physics, University of Texas at Austin — Electric double-layer transistors (EDLTs) using ionic liquid as the gate dielectric have demonstrated a remarkably wide range of density modulation, a condition crucial for the study of novel electronic phases in complex quantum materials. Yet little is known microscopically when carriers are modulated in the EDLT structure because of the technical challenge to image the buried electrolyte-semiconductor interface with nanoscale resolution. Using a cryogenic microwave impedance microscope, we demonstrate the real-space conductivity mapping in ZnO EDLTs with a spatial resolution of 100nm. A thin layer of ion gel, which solidifies below the glass transition temperature of 200K, was spin-coated on the ZnO surface to induce the metal-insulator transition. The microwave images acquired at different channel conductance clearly showed the spatial evolution of local conductivity through the transition. In addition, by applying a large source-drain bias, electrical inhomogeneity was also observed across the source and drain electrodes.

Yuan Ren
Department of Physics, Univ of Texas at Austin

Date submitted: 12 Nov 2014 Electronic form version 1.4