MAR17-2016-020023
Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

New Insight into the Metal-to-Insulator Transition in Vanadium Dioxide.[1]

KEVIN E. SMITH, Department of Physics, Boston University

The metal-insulator transition (MIT) in VO_2 is of both fundamental and technical interest, the former due to important questions about its origins, and the latter due to possible applications in electronic devices such as ultrafast optical switches and field effect transistors. In bulk VO_2, a large structural distortion accompanies the conductivity transition from the metallic (rutile) to the insulating (monoclinic) phase, which is known to impose a significant bottleneck on the timescale of the transition. Recently, the ability to control the transition temperature of the MIT in VO_2 through chemical doping and/or nanoscale engineering has heralded renewed interest in VO_2 as a novel functional material. I will present the results of synchrotron radiation-excited photoemission, x-ray emission, and x-ray absorption spectroscopy studies of the MIT in strained VO_2 thin films. Our results reveal that the MIT may be driven towards a purely electronic transition, (i.e. one without a crystal symmetry transition), by the application of mechanical strain. Comparison with a moderately strained system, which does involve the lattice, demonstrates a crossover from Peierls-like to Mott-like transitions. We furthermore have observed striped phases through the transition, and these reveal new information on the nature of the MIT.

[1]Research supported by the Department of Energy, and undertaken at the Advanced Light Source and at MAXLab