Abstract Submitted
for the NWS08 Meeting of
The American Physical Society

Metal-insulator phase boundary in VO_2 nanobeams[1] JIANG WEI, WEI CHEN, ZENGHUI WANG, DAVID COBDEN, University of Washington — Vanadium dioxide nanobeams show the same dramatic metal-insulator transition as does bulk VO_2, occuring at about 67 degrees C under ambient conditions. The transition is first-order, accompanied by an abrupt and rapid changes in the electronic and optical properties, a latent heat, and a lattice distortion. In the bulk the transition is frustrated, leading to sample degradation, but in nanobeams this is not the case. As a result, in end-clamped nanobeams under tension we are able to investigate a regime of coexistence of the metallic and insulating phases. We find that the resistivity of the insulating phase along the phase boundary is independent of temperature. Furthermore the MIT occurs from the intermediate M2 insulating phase, which we detect near the transition by its higher resistivity, but not directly from the low-temperature M1 phase. These results imply that the MIT is triggered by carrier density and therefore involves electron correlations, and suggest that it takes place in the undimerized vanadium chains present in M2 but not in M1. More generally, these studies illustrate the scientific and technological potential of strongly correlated materials in nanoscale form.

[1]This work was supported by the Army Research Office.

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Date submitted: 18 Apr 2008 Electronic form version 1.4