Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Dependence of VO_2 thin-film metal-insulator transition on its intrinsic impurities CHANGHONG CHEN[1], YONG ZHAO, ZHAOYANG FAN, Nano Tech Center and Department of Electrical and Computer Engineering, Texas Tech University — We present variation in strain, metal-insulator transition temperature (T_{MIT}), activation energy (ΔE_a), and charge carrier type in the insulating phase of (011) preferred polycrystalline (Poly-) and multidomain (020) epitaxial (Epi-) VO_2 films grown at different temperature (T_S), to produce variable intrinsic impurities. Both the Poly- and Epi-VO_2behave n-type conductivity when grown at relative low T_S. As T_S increases, acceptor density of impurity increases to alter conductivity from n- to p-type in the Poly-VO_2, while conductive n-type still keeps in the Epi-VO_2 with increased donor density. Moreover, the strain along monoclinic a_m axis dramatically reverses from tensile to compressive in both the Poly-(848 K$<T_S<$873 K) and Epi-VO_2(873 K$<T_S<$898 K), and eventually tend to relaxation again in the Poly-VO_2($T_S \geq$898 K) in particular. Consequently, T_{MIT} decreases with increasing the carrier density independent of the conductive type, and low-temperature ΔE_a is associated with the strain. The larger strain leads to higher ΔE_a, while the relaxed strain produces saturated or the minimum ΔE_a in the Poly- or Epi-VO_2.

[1]Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology

Zhaoyang Fan
Nano Tech Center and Department of Electrical and
Computer Engineering, Texas Tech University

Date submitted: 23 Nov 2010 Electronic form version 1.4