Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Correlation of Valence State and Transport Properties in VO_2 Films[1] SALINPORN KITTIWATANAKUL, Physics Department, University of Virginia, JUDE LAVEROCK, Physics Department, Boston University, STUART WOLF, Physics Department, University of Virginia, JIWEI LU, Materials Science and Engineering Department, University of Virginia — Vanadium dioxide (VO_2) exhibits a metal semiconductor transition (MST) that is accompanied by the abrupt change in the electrical conductivity, optical transmittance and reflectance in infrared region, which can be used in electronic devices such as temperature sensors and electric switches. VO_2 thin films were grown on c-plane Al_2O_3 substrates with different O_2 flow rates. The XRD scans have been performed to confirm the single phase and highly textured VO_2 films despite the change in the growth parameter, i.e. the oxygen partial pressure. The valence state of vanadium on different films was investigated by soft x-ray spectroscopy. The Hall bars were fabricated for electrical transport and Hall measurements. As the O_2 flow rate increases, the XRD results show decreasing lattice parameter, hence increasing compressive strain along b-axis of monoclinic VO_2; the transport measurements also show the increasing transition temperature (T_{MST}) and the increasing change in resistivity associated with the strain and valence state of vanadium. Hall measurements reveal a sudden increase in carrier concentration from 10^{20} to 10^{24} cm^{-3} around T_{MST}, while the mobility remains constant before and after MST. The correlation among the valence state, the strain and MST in VO_2 will be discussed.

Salinporn Kittiwatanakul
Physics Department, University of Virginia

[1] Authors are thankful to financial supports from VMEC and NRI.

Date submitted: 07 Nov 2011 Electronic form version 1.4