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Effect of thickness on the film strain and metal-semiconductor transition of VO_2 thin films SALINPORN KITTIWATANAKUL, STUART WOLF, Physics, University of Virginia, JIWEI LU, Materials Science and Engineering, University of Virginia — Many applications of VO_2 will benefit from the extensive tunability of the Metal to Semiconductor Transition (MST) of VO_2, which is very sensitive to the film strain and the oxygen stoichiometry [1,2]. Reactive Bias Target Ion Beam Deposition was used to deposit epitaxial VO_2 thin films on (100), (011), and (001) TiO_2 substrates, and highly textured VO_2 on c-Al_2O_3 with thicknesses in the range of 5-17 nm. X-ray diffractometry confirmed the single-phase nature of the VO_2 films, and was also used to determine the lattice parameters. Due to the substrate clamping effect, there are very large strains introduced (up to 3.4%), that affect the transition temperatures (T_{MST}). For the 5nm VO_2/(100) TiO_2, T_{MST} is raised above 430 K, which is much higher than in previous reports. The resistivity of this sample changed about 4 orders of magnitude during the transition from a semiconductor to a metal.

[1] S Kittiwatanakul, et al., Journal of Applied Physics 114 (5), 053703-053703-5 (2013)
[2] K. G. West, et al. Journal of Vacuum Science & Technology A 26(1): 133-139 (2008)

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