Work function recovery of air exposed molybdenum oxide thin films with vacuum annealing

IRFAN IRFAN, University of Rochester, ALEXANDER TURNISKE, University of Wisconsin, ZHENAN BAO, Stanford University, YONGLI GAO, University of Rochester — We report substantial work function (WF) recovery of air exposed molybdenum oxide thin films with vacuum annealing. The high WF (∼6.8 eV) of thermally evaporated MoO$_x$ thin film was observed to decrease sharply to ∼5.6 eV with an air exposure of one hour. The drop in the WF was accompanied with a very thin layer of oxygen rich adsorbate on the MoO$_x$ film. The WF of the exposed MoO$_x$ film started to gradually recover with increasing annealing temperature in a vacuum chamber having base pressure of 8 x 10$^{-11}$ torr. The saturation in the WF recovery was observed around 460 °C, with WF ∼6.4 eV. The adsorb layer was found to be removed after the vacuum annealing. We further studied the interface formation between the annealed MoO$_x$ and copper pthalocynine (CuPc). The highest occupied molecular orbital (HOMO) level of CuPc was observed to be almost pinned to the Fermi level, strongly suggesting an efficient hole injection through the vacuum annealed MoO$_x$ film.