Structural and electrical characterization of NbO$_2$ vertical devices grown on TiN coated SiO$_2$/Si substrate$^1$ TOYANATH JOSHI, PAVEL BORISOV, West Virginia University, Morgantown, WV, DAVID LEDERMAN, West Virginia University, Morgantown, WV, University of California, Santa Cruz, CA — Due to its relatively high MIT temperature (1081 K) and current-controlled negative differential resistance, NbO$_2$ is a robust candidate for memory devices and electrical switching applications. In this work, we present in-depth analysis of NbO$_2$ thin film vertical devices grown on TiN coated SiO$_2$/Si substrates using pulsed laser deposition (PLD). Two of the films grown in 1 mTorr and 10 mTorr O$_2$/Ar (~7% O$_2$) mixed growth pressures were studied. The formation of NbO$_2$ phase was confirmed by Grazing Incidence X-ray Diffractometry (GIXRD), X-ray Photoelectron Spectroscopy (XPS) and current vs. voltage measurements. A probe station tip (tip size ~2 μm) or conductive AFM tip was used as a top and TiN bottom layer was used as a bottom contact. Device conductivity showed film thickness and contact size dependence. Current pulse measurements, performed in response to applied triangular voltage pulses, showed a non-linear threshold switching behavior for voltage pulse durations of ~100 ns and above. Self-sustained current oscillations were analyzed in terms of defect density presented in the film.

$^1$Supported by FAME (sponsored by MARCO and DARPA, Contract 2013-MA-2382), WV Higher Education Policy Commission grant (HEPC.dsr.12.29), and WVU SRF. We also thank S. Kramer from Micron for providing the TiN-coated Si substrates.

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Date submitted: 06 Nov 2015

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