Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Lateral V/VO_x/V Tunnel Junctions Formed by Anodic Oxidation

DAVID KIRKWOOD, KEVIN WEST, JIWEI LU, STUART WOLF, University of Virginia — Anodization has been found to be a simple and cost effective technique to produce oxide films of many transition metals. In this work, we have used anodic oxidation as a means of fabricating lateral V/VO_x/V junctions. Vanadium wires grown by ion beam deposition were patterned by lithography and an active working window was defined on the wire. VO_x was then grown under galvanostatic control in a two electrode electrochemical micro-cell. A droplet of oxygen rich saturated Boric acid was used as the electrolyte to electrically connect the Vandium working electrode to a Platinum wire counter electrode. A constant current of approximately 100 μA/cm^2 was maintained through the cell for various amounts of time. Electrical measurements of the resulting V/VO_x/V junctions indicate a metal to insulator transition (MIT) near 340 ^{o}K that is similar to the structural phase transition and accompanied MIT of VO_2 which occurs at this temperature. A 4-fold change in resistance is observed in the junctions. Below this transition temperature a typical junction behavior is observed with a dramatic change in resistance state from high to low with increasing applied current. This non-linear IV characteristic on the junction with a size of 5 μm by 15 μm suggests that the anodized VO_x film behaves like a tunneling barrier.

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Date submitted: 27 Nov 2007 Electronic form version 1.4