Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Investigation of switching behavior of two-terminal devices on VO_2[1] IULIANA P. RADU, Katholieke Universiteit Leuven and IMEC, Belgium, KOEN MARTENS, BOGDAN GOVOREANU, SOFIE MERTENS, XIAOPING SHI, MALGORZATA JURCZAK, IMEC, Belgium, STEFAN DE GENDT, Katholieke Universiteit Leuven and IMEC, Belgium, ANDRE STESMANS, Katholieke Universiteit Leuven, JORGE A. KITTL, IMEC, Belgium, MARC HEYNS, Katholieke Universiteit Leuven and IMEC, Belgium — Vanadium dioxide undergoes an insulator to metal transition at about 68 $^\circ$C. Two-terminal devices fabricated on VO_2 show a steep decrease of resistance when the current or voltage applied are large enough. This switching has been largely attributed to a field effect even in two-terminal devices but controversy still exists. We fabricate devices with an array of electrode separations and widths and study how the dc switching voltage and current depend on device size. The data obtained from these devices are most consistent with a Joule heating mechanism governing the switching. Additionally we perform an ac investigation of these devices and find that the switching to the low resistance state can happen faster than 5ns (the time resolution of the measurement set-up) while the switching to the high resistance state is of the order of hundreds of nanoseconds, consistent with the estimated heat dissipation time. In spite of the Joule heating mechanism which is expected to induce device degradation, we find that the devices can be switched for more than 10^{10} cycles making VO_2 a promising material for memory applications.

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[1]We acknowledge support from the Katholieke Universiteit Leuven, IMEC, Belgium and a Marie Curie grant.

Date submitted: 08 Nov 2011 Electronic form version 1.4