Abstract Submitted for the MAR12 Meeting of The American Physical Society

Field-effect modulation of conductance nanobeam transistors with HfO₂ as the gate dielectric SHAMASHIS SENGUPTA, Department of Condensed Matter Physics and Materials Science, Tata Institute of Fundamental Research, Mumbai, KEVIN WANG, KAI LIU, Department of Materials Science and Engineering, University of California, Berkeley, AJAY BHAT, SAJAL DHARA, Department of Condensed Matter Physics and Materials Science, Tata Institute of Fundamental Research, Mumbai, JUNQIAO WU, Department of Materials Science and Engineering, University of California, Berkeley, MANDAR M. DESHMUKH, Department of Condensed Matter Physics and Materials Science, Tata Institute of Fundamental Research, Mumbai — Field-effect transistors have been fabricated from VO₂ nanobeams using HfO₂ as the gate dielectric. When heated up from low to high temperatures, VO₂ undergoes an insulator-to-metal transition. We observe a change in conductance (6 %) of our devices induced by gate voltage when the system is in the insulating phase. The response is reversible and hysteretic, and the area of the hysteresis loop becomes larger as the rate of gate sweep is slowed down. A phase lag exists between the response of the conductance and the gate voltage. This indicates the existence of a memory of the system involving a timescale of a few minutes. The origin of such slow processes may lie in the coupling between the dipolar arrangement and the strain state of the VO₂ crystal.

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Date submitted: 28 Nov 2011 Electronic form version 1.4