Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Fabrication and characterization of SnO2 nanobelt field effect transistors YI CHENG, S. VON MOLNAR, P. XIONG, MARTECH/Physics Department, Florida State University, LENWOOD FIELDS, J.P. ZHENG, Department of Electrical and Computer Engineering, FAMU/FSU College of Engineering, R. YANG, Z.L. WANG, School of Materials Science and Engineering, Georgia Institute of Technology — Single-crystalline SnO_2 nanobelts have been produced by thermal evaporation of oxide powders in a tube furnace without any chemical catalyst. Individual SnO_2 nanobelts with thicknesses of 30nm$\sim$300nm and lengths as long as several hundred μm were dispersed onto a doped Si/SiO_2 substrate, and multi-terminal metal electrodes were defined on a nanobelt using photolithography. An individual nanobelt was then characterized by measuring current–voltage characteristics as a function of temperature using 4-probe measurement. Temperature dependence of the resistivity is characteristic of a doped semiconductor. A field effect transistor (FET) is formed using a nanobelt as the channel and doped Si as the gate. Electrical measurements revealed characteristic behavior of an n-channel depletion-mode FET, with well-defined linear and saturation regimes, a threshold voltage of $\sim$-15V, and on/off ratio as high as 10^3. The channel mobility is estimated to be 25 $cm^2/V{\cdot}s$, and carrier concentration about $6x10^{15}$ cm^{-3}. The results demonstrate the potential of using SnO_2 nanobelt to construct high performance nanoFET with possible applications as chemical and biological sensors. This work is supported by NSF NIRT grant ECS-0210332.

Yi Cheng
MARTECH/Physics Department, Florida State University

Date submitted: 27 Mar 2013 Electronic form version 1.4