Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Semiconducting Oxide Nanobelt Field Effect Transistors: Characteristics and Applications YI CHENG, 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 ZnO and SnO_2nanobelts with thickness of 10 -150 nm were synthesized by thermal evaporation of oxide powders without any catalyst. Field-effect transistors have been fabricated based on these oxide nanobelts, using a doped-Si/SiO_2 substrate. Multi-terminal electrical contacts to individual nanobelts were defined by photolithography, which enabled us to correlate the FET characteristics with the behavior of the contacts. FETs with nonohmic high-resistance contacts showed enhancement mode Schottky barrier FET behavior. In contrast, in devices with low-resistance ohmic contacts, characteristics of an n-channel depletion-mode FET were observed, with ON/OFF ratio as high as 10^3 (ZnO) and 10^5 (SnO_2), and well-defined linear and saturation regimes. Electrical measurements also revealed high transconductance and field-effect mobility for these nanobelt FETs. Effects of surface oxygen adsorption and desorption have been studied by monitoring the transport properties of SnO_2 nanobelt FET in different gas flow. Importantly, the FET characteristics of the SnO_2 device showed significant modification by a 2% hydrogen gas flow at room temperature. *This work is supported by NSF NIRT grant ECS-0210332.

Yi Cheng
MARTECH/Physics Department, Florida State University

Date submitted: 29 Nov 2005 Electronic form version 1.4