Abstract Submitted
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Tailoring electronic properties of SnO2 nanobelts via thermal annealing[1] JORGE BARREDA, TIMOTHY KEIPER, JOON-IL KIM, PENG XIONG, Florida State University Department of Physics, JIM P. ZHENG, Electrical and Computer Engineering, FAMU/FSU College of Engineering — Nanostructures of semiconducting metal oxides display many desirable characteristics for nano-electronics and sensing applications. Nanobelts (NBs) of SnO_2 have been synthesized using catalyst-free chemical vapor deposition of SnO powder. Channel-limited field-effect transistors (FETs) have been produced from the NBs and their use as effective gas [1], pH [2], and protein [3] sensors has been demonstrated. We investigate the control and optimization of the electronic properties of the NBs for biosensing applications by varying the oxygen stoichiometry via thermal annealing in oxygen and vacuum. Annealing our NBs in O_2 environment at 800°C for 2hrs prior to the FET fabrication produces devices with conductance in the range of millisiemens, suggesting an increase in oxygen vacancies. Subsequent vacuum annealing allows tuning of the conductivity of the NBs. We demonstrate significant modulation of the current through the FET channel with an applied backgate voltage, indicating our devices are acceptable candidates for sensing charged biomolecules. Silane chemistry is used for the selective biofunctionalization of the NB-FETs. Antibody-antigen binding is detected by a change in the NB conductance after exposure to an analyte containing the specific antigen.

[1]References: [1] Yi Cheng et al., Appl. Phys. Lett. 89, 093114 (2006). [2] Yi Cheng et al., Nano Lett. 8, 4179-4184 (2008). [3] Yi Cheng et al., Biosensors and Bioelectronics 26, 4538-4544 (2011).

Timothy Keiper
Florida State University Department of Physics

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