Electrical Characterization of single GaSb Nanowire Field Effect Transistor

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Among III–V compound semiconductors, GaSb seems to be one of the potential choices and promising candidates for high speed electronic and long wavelength photonic devices, due to its high mobility and low band gap properties.[1] Gasb nanowires are ideal structures for lasers in photonic integrated circuits that have distinct advantages over current planar heterostructure semiconductor lasers.[2] In this paper, we'll discuss about the fabrication and electrical characterization of GaSb nanowire field effect transistor (FET).

The GaSb nanowires are synthesized using the spontaneous nucleation and growth technique and are unintentionally doped. [3] Following growth, the wires are removed from the growth substrate, suspended in alcohol, and dispersed onto SiO2 substrates for device fabrication. The Au/Cr contacts are fabricated using Electron Beam Lithography (EBL), followed by thermal evaporation and lift-off.

The electrical measurements presented in this work are performed without the device annealing. The current-voltage characteristic shows asymmetric current through the device due to asymmetric schottky contacts at the two ends of the wire. The gate response results indicate the unintentionally doped nanowire to be n-type. By shining the light, photo-response from the device can be observed. In addition, by varying the temperature, we can see clear temperature dependent current changes through the device. Further details of this approach and additional experimental and simulation results will be presented.

[1]. P. S. Duttaa and H. L. Bhat, J. Appl. Phys. 81 (9), 1 May 1997
[2]. A. H. Chin, S. Vaddiraju, and C. Z. Ning, Appl. Phys. Letter S 88, 163115 _2006
[3]. S. Vaddiraju, A. Mohite, A. Chin, M. Meyyappan, G. Sumanasekera, B. W. Alphenaar, and M. K. Sunkara, Nano Lett. 5, 1625 _2005.

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