Engineers Make Standardized Bulk Synthesis of Nanowires Possible

November 23 2005

A team of Yale scientists have demonstrated a method to understand effective synthesis of semiconductor nanowires (NWs) for both their quality and quantity, according to a report published in the journal *Nanotechnology*.

Graduate student Eric Stern in the department of biomedical engineering along with his colleague Guosheng Cheng, associate research scientist in electrical engineering systematically varied and tested parameters for producing GaN NWs using an optical lithographic method as a template for testing characteristics of the NWs.

A nanowire is an ultra-miniaturized cylindrical semiconductor, as small as 1 to 100 nanometers in diameter, and extending as long as a millimeter — or 10,000 times its thickness. One nanometer is approximately a 25-millionth of an inch. GaN was chosen for these experiments as a material commonly employed in synthesis of semiconductors.

Development of reliable NW fabrication will allow the exploration of the next steps in semiconductor miniaturization. This reported technology produces ten-times the number of NWs as previous technology and sets parameters for standardization of NWs.

“This brings nanowires to an interface with the rest of the world of semiconductor research,” said Stern. “Until this point, the greatest hurdle for the technology has been the inability to produce more than individual

nanowires and to have statistically reproducible synthesis so that the properties of nanowires can be explored."

Their study also demonstrated the proof-of-principle that the NWs act as scaled FETs (field effect transistors), the technology commonly used in microelectronics.

Other authors from the faculty of engineering and the department of physics at Yale include, senior author M. A. Reed, and E. Cimpoiasu, S. Guthrie , J. Klemic, I, Kretzschmar, E. Steinlauf, D. Turner-Evans, E. Bromfield, J. Hyland, R. Koudelka, T.Boone, M. Young, A. Sanders, R Munden, T. Lee and D. Rutenberg; author R. Klie is from Brookhaven National Laboratory. This research was partially supported by DARPA under SPAWAR , ARO, AFOSR, NASA, the Department of Homeland Security, and the National Science Foundation.

Citation: *Nanotechnology* 16(12): 2941-2953 (December 2005). Also available online.

Source: Yale University