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FAST BREAKING PAPERS - 2009

April 2009

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Claes Thelander talks with *ScienceWatch.com* and answers a few questions about this month's Fast Breaking Paper in the field of Engineering.

Article Title: Vertical enhancement-mode InAs nanowire field-effect transistor with 50-nm wrap gate
Authors: Thelander, C;Froberg, LE;Rehnstedt, C;Samuelson, L;Wemersson, LE
Journal: IEEE ELECTRON DEV LETT
Volume: 29
Issue: 3
Page: 206-208
Year: MAR 2008
* Lund Univ, S-22100 Lund, Sweden.
* Lund Univ, S-22100 Lund, Sweden.
* Qumat Technol AB, Lund 22224, Sweden.

SW: Why do you think your paper is highly cited?

There is a considerable effort worldwide in trying to find a successor to the transistor technology that today is based on silicon. The indium arsenide (InAs) transistor is one candidate, where a narrow semiconductor bandgap allows for low-power switching and fast operation, which is particularly important for handheld electronics. We have demonstrated a fabrication technique and transistor performance that appears very encouraging for future work in this field.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

The field of nanowires has been very actively researched during the past 10 years, but it has generally been difficult to go from the level of an individual test device to something that shows promise for upscaling. We believe that we took the technology one step further by putting many pieces together, such as implementing a high-k gate dielectric (HfO_2), together with a short wrap-around gate in a vertical transistor geometry.

"We went through a long period of "trial and error" to find proper processing conditions and chemicals that are compatible with InAs."

SW: Would you summarize the significance of your paper in layman's terms?

The paper demonstrates that vertical nanowires can be a promising alternative for future transistors. The transistor itself is based on a relatively uncommon and expensive material (InAs). However, research by our group and others has recently shown that nanowires of this material can be grown on cheap silicon wafers, which means that such high-performance transistors may also be quite inexpensively produced.

SW: How did you become involved in this research, and were there any problems

along the way?

I have worked in this field for quite some time, but my involvement in the past has mostly been limited to quantum transport studies of nanowires. My involvement in the transistor project started when the European Union launched a collaborative research project in this area. There have indeed been problems in the project; particularly since InAs is a rather delicate material from a processing point of view. We went through a long period of trial and error in order to find proper processing conditions and chemicals which are compatible with InAs.

SW: Where do you see your research leading in the future?

We will next look into the high-frequency properties of these transistors, to see how far we can push the technology. After that we will most likely look into new types of semiconductors for improved transistor performance, possibly with the development of new switching processes.

SW: Do you foresee any social or political implications for your research?

If this research is successful, there is of course a chance that it can have an impact on the electronics industry, leading to faster and power-saving electronics. In that sense, I hope that it may have both a positive economic and environmental impact.

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KEYWORDS: TRANSISTOR; INDIUM ARSENIDE; NARROW SEMICONDUCTOR BANDGAP; HIGH-K GATE DIELECTRIC; NODE-PROJECT.

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