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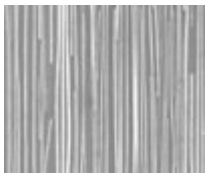
TECHNOLOGY UPDATE

Jan 29, 2008

Nanowires line up for wafer-scale process

Wafer-scale assembly of highly ordered semiconductor nanowires has proved to be a stumbling block in the development of nano-enabled electronics, but researchers in the US are on the case. Ali Javey's group at the University of California at Berkeley has perfected a simple contact printing process that utilizes a clever sliding motion to align nanowires on lithographically patterned substrates.

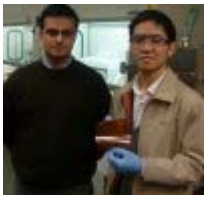


Nanowires

Key to the method's success is the use of a lubricant (a mixture of octane and mineral oil) to help transfer the nanowires from a lawn-like growth substrate onto the receiving wafer. The fluid serves as a spacing layer between the donor and receiving surfaces and minimizes nanowire–nanowire friction to maximize alignment during the sliding step.

Any residues are easily removed from the substrate by simply rinsing the surface with octane or isopropanol – a procedure that has been confirmed using atomic force microscopy.

The printing process suits a wide range of nanowire materials, including silicon, germanium and compound semiconductors, and has been tested on nanowires measuring from 10 to 100 nm in diameter.



Flexible approach

One of the most exciting developments is the ability to create a stack of highly ordered cross arrays. For example, a layer of nanowires is first contact printed on the receiver substrate. Next, the sample is spin coated with a buffer layer, rotated and then a second printed layer is applied over the first.

"Potentially, this means that we can extend the process to fabricate LEDs," Ali Javey of the university's nanomaterials and electronics laboratory told *nanotechweb.org*. "One nanowire layer would consist of an n-type semiconductor, while the other layer would be made from p-type material."

The team has shown that its approach works not just on silicon wafers, but also on plastics, which opens the door to flexible optoelectronics. "So far, we have used photolithography to achieve our patterned nanowire assembly, but in the future inkjet printing may be used to deliver an all printable fabrication strategy," he added.

The researchers presented their work in *Nano Letters*.

About the author

James Tyrrell is editor of *nanotechweb.org*