Nanowire lawns make for sheets of image sensors

22:00 28 July 2008
NewScientist.com news service
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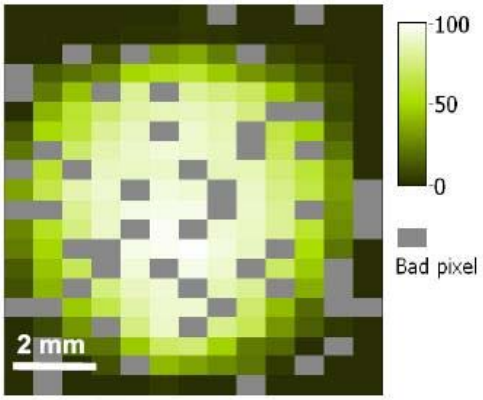
Growing a mixed "lawn" of two kinds of nanowires can make a new kind of light-sensing array that could be made in metre-scale sheets. The researchers behind the prototype say such cheap, high-quality image sensors would allow uses not conceivable using today's more expensive technology.

Current sensors, such as those found in digital cameras, are made like any other silicon chip – they are carved out from a block of material. The new nanowire sensors are instead built from the bottom up, using chemically-grown nano-sized components.

A research team led by Ali Javey, at the University of California, Berkeley, developed the process. They start by growing an unruly "lawn" of nanowires on a surface.



Enlarge image
This image of a spot of light was taken using a new image sensor made by growing lawns of nanowires. The approach should make it easy to create meters squared of flexible image sensors (Image: PNAS)

Brush up

The crop is then printed onto another surface, a step that simultaneously tidies them up.

"At the first stage, the nanowires are more-or-less standing up, like a bad hair day. But during the printing process, they effectively get combed," says Javey.

The nanowires, which are a few tenths of a millimetre long and a few tens of nanometres wide, can be printed onto anything from silicon to plastic or paper. Whatever the surface, it must be prepared with a pattern that guides the nanowires to predetermined locations.

To make the functioning sensor, two different "crops" of nanotubes are printed onto the same surface. Cadmium selenide nanowires produce electric charge when hit by light, while those made from silicon-coated germanium act as transistors to amplify that charge.

Proof of concept

The team built a prototype sensor with 260 pixels, each made from up to 5 sensor nanowires for each transistor nanowire. In tests, 80% of the sensor circuits worked as desired (see image, right). "It's the largest integrated device to date based on nanowires," Javey says.

Javey says the arrays are reliable, flexible and easy to scale up. He envisions growing self-powered, wireless versions on rolls of tape several metres in diameter.

"Imagine having a tape – just like your sticky tape – that you can grab and put on anywhere you want," he says. "This tape will have all the needed components to do the active sensing, translate the data, and transmit it wirelessly."

Producing image sensors in large, cheap areas could encourage new uses for imaging to emerge, says Javey. His team is working on the extra parts needed: nano-scale batteries for power and equally small wireless components.

"Outstanding application"

Javey and colleagues are among the very first to successfully demonstrate that different kinds of nanowires can be brought together to make integrated sensor circuitry, says John Rogers, a specialist in organic electronics at the University of Illinois at Urbana-Champaign. "I really like what they have done here," he told **New Scientist**.

Zhong Wang, who leads a nanotechnology group at Georgia Institute of Technology, Atlanta, Georgia, added: "It demonstrates an outstanding application of nanowires in integrated electronics."

Journal reference: *PNAS*, DOI: 10.1073/pnas.0801994105

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