Copper nanowires grown by new process create long-lasting displays

A new low-temperature, catalyst-free technique for growing copper nanowires has been developed by researchers at the University of Illinois. The copper nanowires could serve as interconnects in electronic device fabrication and as electron emitters in a television-like, very thin flat-panel display known as a field-emission display.

“We can grow forests of freestanding copper nanowires of controlled diameter and length, suitable for integration into electronic devices,” said Kyekyoon (Kevin) Kim, a professor of electrical and computer engineering.

“The copper nanowires are grown on a variety of surfaces, including glass, metal and plastic by chemical vapor deposition from a precursor,” said Hyungsoo Choi, a research professor in the Micro and Nanotechnology Laboratory and in the department of electrical and computer engineering. “The patented growth process is compatible with contemporary silicon-processing protocols.”

The researchers describe the nanowires, the growth process, and a proof-of-principle field-emission display in a paper accepted for publication in the journal *Advanced Materials*, and posted on its Web site.

Typically, the nanowires of 70 to 250 nanometers in diameter are grown on a silicon substrate at temperatures of 200 to 300 degrees Celsius and require no seed or catalyst. The size of the nanowires is controlled by the processing conditions, such as substrate, substrate temperature, deposition time and precursor feeding rate. The columnar, five-sided nanowires terminate in sharp, pentagonal tips that facilitate electron emission.

To demonstrate the practicability of the low-temperature growth process, the researchers first grew an array of copper nanowires on a patterned silicon substrate. Then they fashioned a field-emission display based on the array’s bundles of nanowires.

In a field-emission display, electrons emitted from the nanowire tips strike a phosphor coating to produce an image. Because the researchers used a bundle of nanowires for each pixel in their display, the failure of a few nanowires will not ruin the device.

“The emission characteristics of the copper nanowires in our proof-of-principle field-emission display were very good,” said Kim, who also is affiliated with the U. of I.’s department of materials science and engineering, department of bioengineering, department of nuclear, plasma and radiological engineering, Beckman Institute, Micro and Nanotechnology Laboratory, and the Institute for Genomic Biology. “Our experimental results suggest bundled nanowires could lead to longer lasting field-emission displays.”

In addition to working on flexible displays made from copper nanowires grown on bendable plastic, the researchers are also working on silver nanowires.

Source: University of Illinois at Urbana-Champaign