

Farewell Silicon? IBM Touts Carbon Nanotube Breakthrough

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By Stephanie Mlot October 2, 2015 12:10pm EST Comments

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According to IBM, switching from silicon to carbon nanotube chips could boost performance, help battery life, and more.

Carbon Nanotube Valley doesn't have the same ring to it as Silicon Valley, but we might have to live with it, if IBM's newest breakthrough has legs.

IBM Research has "demonstrated a new way to shrink transistor contacts without reducing performance of carbon nanotube devices, opening a pathway to dramatically faster, smaller, and more powerful computer chips beyond the capabilities of traditional semiconductors," the company [announced](#).

This, [according to](#) IBM's VP of Science and Technology, Dario Gil, was "one of the most daunting challenges facing the chip industry."

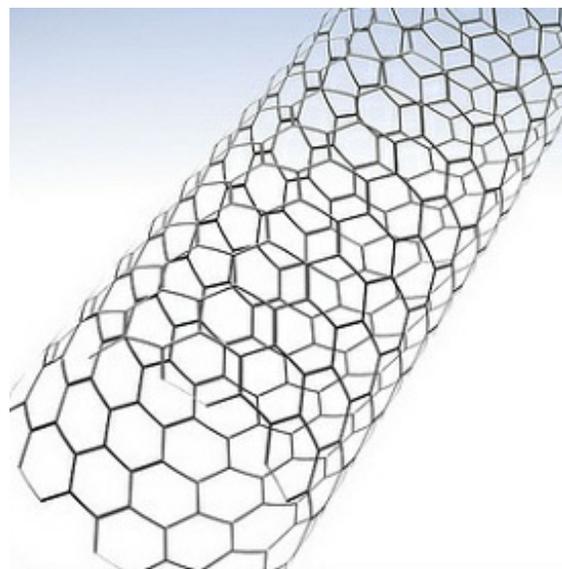
According to IBM, making the switch from silicon to carbon nanotube chips would improve high-performance computers, enable faster analysis of Big Data, increase the power and battery life of mobile devices and the Internet of Things, and allow cloud data centers to run more efficiently and economically.

"As silicon technology nears its physical limits, new materials, devices and circuit architectures must be ready to deliver the advanced technologies that will be required by the Cognitive Computing era," Gil said.

Silicon transistors—the tiny switches that carry information on a chip—have been getting smaller and smaller over the years. But "with [Moore's Law](#) running out of steam, shrinking the size of the transistor including the channels and contacts without compromising performance has been a vexing challenge troubling researchers for decades," IBM said.

Carbon nanotube transistors, on the other hand, "operate as excellent switches at channel dimensions of less than ten nanometers—the equivalent to 10,000 times thinner than a strand of human hair and less than half the size of today's leading silicon technology," IBM said.

As their name suggests, carbon nanotubes are single atomic sheets of carbon rolled into a tube, which form the core of a transistor device. According to IBM, electrons move more easily in carbon transistors than silicon-based devices.



"Inside a chip, contacts are the valves that control the flow of electrons from metal into the channels of a semiconductor," IBM said. "As transistors shrink in size, electrical resistance increases within the contacts, which impedes performance. Until now, decreasing the size of the contacts on a device caused a commensurate drop in performance a challenge facing both silicon and carbon nanotube transistor technologies."

For this demo, researchers ditched traditional contact schemes "and invented a metallurgical process akin to microscopic welding that chemically binds the metal atoms to the carbon atoms at the ends of nanotubes." The contacts could then shrink below 10nm without a performance drop.

"This breakthrough shows that computer chips made of carbon nanotubes will be able to power systems of the future sooner than the industry expected," Gil said.

The tech titan this summer also [unveiled the first 7nm node silicon test chip](#) a step toward replacing traditional silicon devices, and part of its [\\$3 billion chip R&D investment](#).