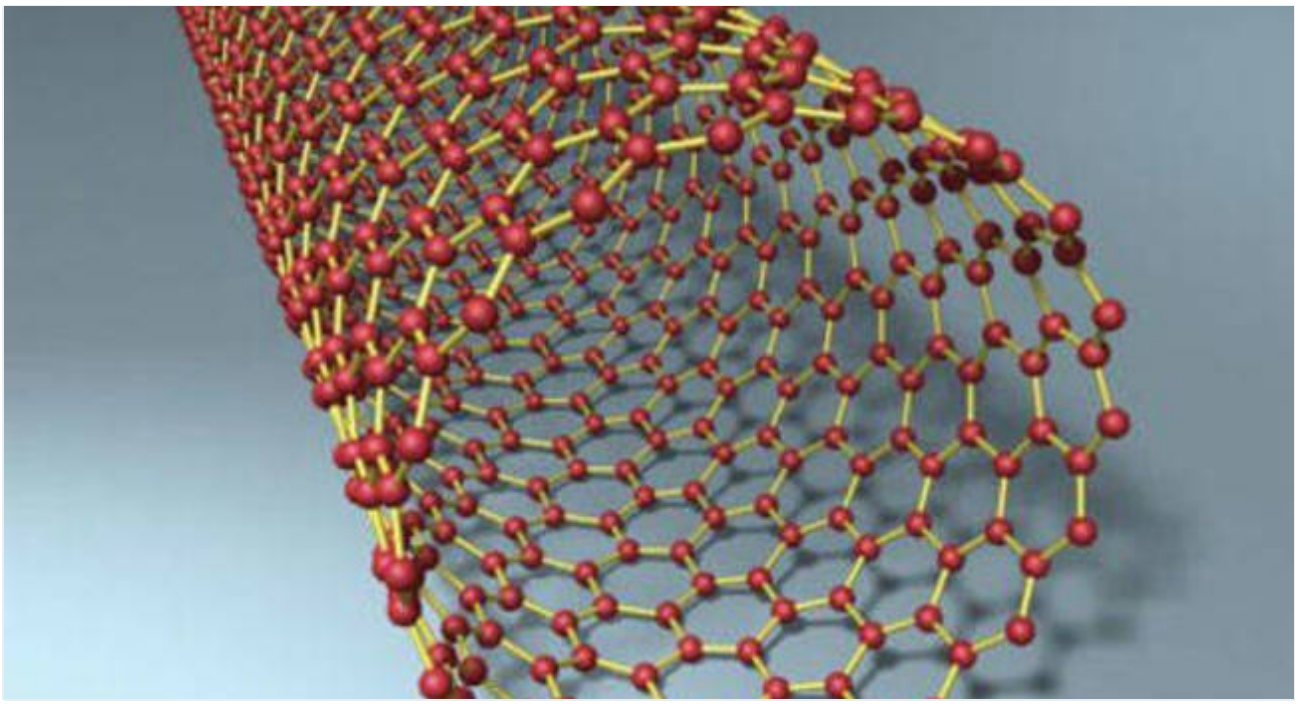
Science

Big Blue welds bits of carbon for nanotube transistor

Bonding beats Ω-ophobia



1 Oct 2015 at 23:58, Richard Chirgwin 23 11 15

IBM has fetched out the hand-on-a-stick to give its back a pat over what it calls a “breakthrough” in carbon nanotube electronics: making a nano-scale contact whose resistance doesn't rise as its size is squeezed.

As part of the world's long search for technologies that can stave off The End of Moore's Law™, and carbon nano-tech is a multi-billion dollar research effort in IBM alone.

IBM's boffins, who have published their work in *Science*, say they've overcome a problem that gets in the way of scaling down feature sizes: contact resistance.

“As devices become smaller, increased contact resistance for carbon nanotubes has hindered performance gains until now. These results could overcome contact resistance challenges all the way to the 1.8 nanometer node – four technology generations away”, the company's announcement states.

The company has already demonstrated carbon nanotube transistors at the 7 nm scale, but if contact resistance kept rising with smaller features, the transistors would suffer increased power demand just to shift electrons through the contacts.

To overcome that the researchers, led by Qing Cao, created an “end-bonded contact scheme that leads to size-independent contact resistance.”

The single-walled carbon nanotube transistor – SWNT – had contacts less than 10 nm long, with device resistance less than 36 kΩ and current above 15 µA per tube.

The contact was created by “the reaction of molybdenum with the SWNT to form carbide”, in what the company says is a process “akin to microscopic welding”.

Nanotubes still need a lot of work to get them out of the laboratory and into mass-manufacture. As leader of the nanotube project Wilfried Haensch told *Technology Review*, the company still needs a better way to separate the semiconducting nanotubes it wants from ones that don't have the right properties.

Manufacturing chips using billions of tubes is also a problem, because the technology isn't compatible with the lithographic techniques that work so well in the silicon world. ®

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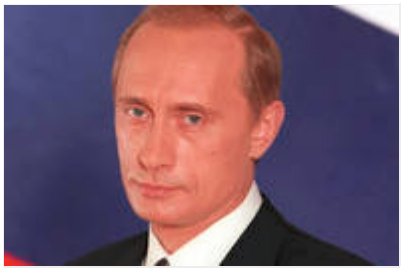

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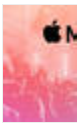

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