High-speed integrated nanowire circuits

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LOS ANGELES, April 27 (Xinhuanet)-- Chemists and engineers said Wednesday they have made robust circuits from minuscule nanowires that align themselves on a chip of glass during low-temperature fabrication, creating rudimentary electronic devices that offer solid performance without high-temperature production or high-priced silicon.

According to this week's journal Nature, scientists produced circuits at low temperature by running a nanowire-laced solution over a glass substrate, followed by regular photolithography to etch the pattern of a circuit.

"As well as potentially enabling powerful electronics to permeate all aspects of modern life, this advance could find application in devices such as low-cost radio-frequency tags and fully integrated high-refresh-rate displays," wrote the researchers led by Charles Lieber and Donhee Ham at Harvard University.

"By using common, lightweight and low-cost materials such as glass or even plastic as substrates, these nanowire circuits couldmake computing devices ubiquitous, allowing powerful electronics to permeate all aspects of living," said Lieber.

"Because this technique can create a high-quality circuit at low temperatures, it could be a technology that finally decouples quality electronics from single crystal silicon wafers, which are resilient during high-temperature fabrication but also very expensive."

Researchers used their technique to produce nanowire-based logical inverters and ring oscillators, which are inverters in series. The ring oscillator devices, which are critical for virtually all digital electronics, performed considerably better than comparable ring oscillators produced at low temperatures using organic semiconductors, achieving a speed roughly 20 times faster.

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The nanowire-derived ring oscillators reached a speed of 11.7 megahertz, outpacing by a factor of roughly 10,000 the excruciatingly slow performance attained by other nanomaterial circuits.

"These nanowire circuits' performance was impressive," said Ham,an assistant professor of electrical engineering. "This finding gives us confidence that we can ramp up these elementary circuits to build more complex devices, which is something we now plan to do."

Lieber and Ham said these functional nanowire circuits demonstrate nanomaterials' potential in electronics applications. The circuits could be used in devices such as low-cost radio-frequency tags and fully integrated high-refresh-rate displays.

On a larger scale, such circuits could provide a foundation formore complex nanoelectronics. The technique to produce a nanowire-based circuit on a glass substrate is also compatible with other commonplace materials such as plastics, broadening its potential applicability, researchers said. Enditem

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