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Nanotechnology builds flexible electronic circuits from random networks of carbon nanotubes

A nanotech approach assembles flexible electronic circuits from random networks of single-walled carbon nanotubes. The method relies on elaborate calculations to determine the optimum size of small- to medium-sized integrated circuits so that contaminating metallic nanotubes do not short circuit the network of semiconducting nanotubes. From Purdue University, via AAAS EurekAlert "'Nanonet' circuits closer to making flexible electronics reality":

> Researchers have overcome a major obstacle in producing transistors from networks of carbon nanotubes, a technology that could make it possible to print circuits on plastic sheets for applications including flexible displays and an electronic skin to cover an entire aircraft to monitor crack formation.
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> The so-called "nanonet" technology — circuits made of numerous carbon nanotubes randomly overlapping in a fishnet-like structure — has been plagued by a critical flaw: The network is contaminated with metallic nanotubes that cause short circuits.
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> The discovery solves this problem by cutting the nanonet into strips, preventing short circuits by breaking the path of metallic nanotubes.
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> "This is a fundamental advance in how nanotube circuits are made," said Ashraf Alam, a professor of electrical and computer engineering at Purdue University. He is working with Kaushik Roy, Purdue's Roscoe H. George Professor of Electrical and Computer Engineering, and doctoral students Ninad Pimparkar and Jaydeep P. Kulkarni.
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> Researchers at the University of Illinois at Urbana-Champaign led experimental laboratory research to build the circuits, and Purdue led research to develop and use simulations and mathematical models needed to design the circuits and to interpret and analyze data.
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> Findings will be detailed in a research paper appearing in the journal *Nature* on July 24 [abstract].
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> ...The researchers created a flexible circuit containing more than 100 transistors, the largest nanonet ever produced and the first demonstration of a working nanonet circuit, Alam said.
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> "Now there is no fundamental reason why we couldn't develop nanonet technologies," he said. "If you can make a flexible circuit with 100 transistors, you can make circuits with 10,000 or more transistors."
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> The advance may allow researchers to use carbon nanotube transistors to create high-performance, shock-resistant, lightweight and flexible integrated circuits at low cost, Alam said.
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> A key advantage of the nanonet technology is that it can be produced at low temperatures, enabling the transistors to be placed on flexible plastic sheets that would melt under the high temperatures required to manufacture silicon-based transistors, he said.
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> Possible applications include an electronic skin that covers an aircraft and automatically monitors the formation of cracks to alert technicians and prevent catastrophic failures.

—Jim

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