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Nanotube networks make the link

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Researchers at the University of California Los Angeles, US, have studied networks of single-walled carbon nanotubes. They found that the networks were transparent and conducting, while their direct current conductivity showed two-dimensional percolation behaviour.

George Grüner and colleagues made their networks by vacuum filtration of a suspension of single-walled nanotubes in chloroform, using a 60 μm thick alumina membrane. To form denser networks, they increased the volume of suspension filtered through the membrane.

The networks did not conduct electricity unless they contained a minimum nanotube density, ie were above the percolation threshold. They also exhibited good transparency.

"The subject of percolation is an important field in its own right, and the so-called percolation transition of a random network with varying densities is one of the interesting realizations of the concept," George Grüner of the University of California Los Angeles told *nanotechweb.org*. "The nanotube network we have fabricated allows the examination of the phenomena associated with such a transition in two dimensions, where very little has been accomplished."

The networks could have applications in devices that need transparent electrodes, such as displays, solar cells and optoelectronic devices, in flexible transistors and in sensors. The researchers say the networks have optical parameters close to those of indium tin oxide - the standard material used as a transparent conductor.

"The high electron and hole mobility allows the fabrication of a rare and highly transparent network retaining substantial conductivity," said Grüner.

The materials could also have applications in flexible electronics. "The third application is sensors, as one can capitalize on the fact that the conducting channel is at the surface, thus interaction with the environment is significant," added Grüner. "The devices can be tailor-made for recognition of chemical and bio-molecules by combining the architecture with recognition layers."

The researchers reported their work in *Nano Letters*.

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