Nanotube composites increase the efficiency of next generation of solar cells

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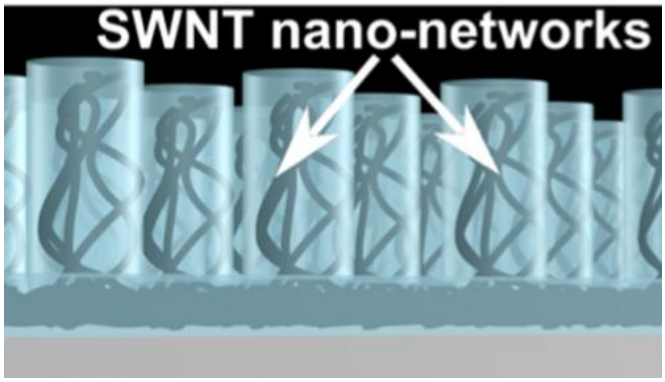

Carbon nanotubes are becoming increasingly attractive for photovoltaic solar cells as a replacement to silicon. Researchers at Umeå University in Sweden have discovered that controlled placement of the carbon nanotubes into nano-structures produces a huge boost in electronic performance. Their groundbreaking results are published in the prestigious journal *Advanced Materials*.

Carbon nanotubes, CNTs, are one dimensional nanoscale cylinders made of carbon atoms that possess very unique properties. For example, they have very high tensile strength and exceptional electron mobility, which make them very attractive for the next generation of organic and carbon-based electronic devices.

There is an increasing trend of using carbon based nanostructured materials as components in solar cells. Due to their exceptional properties, carbon nanotubes are expected to enhance the performance of current solar cells through efficient charge transport inside the device. However, in order to obtain the highest performance for electronic applications, the carbon nanotubes must be assembled into a well-ordered network of interconnecting nanotubes. Unfortunately, conventional methods used today are far from optimal which results in low device performance.

In a new study, a team of physicists and chemists at Umeå University have joined forces to produce nano-engineered carbon nanotubes networks with novel properties.

For the first time, the researchers show that carbon nanotubes can be engineered into complex network architectures, and with controlled nano-scale dimensions inside a polymer matrix.

"We have found that the resulting nano networks possess exceptional ability to transport charges, up to 100 million times higher than previously measured carbon nanotube random networks produced by conventional methods," says Dr David Barbero, leader of the project and assistant professor at the Department of Physics at Umeå University.

The high degree of control of the method enables production of highly efficient nanotube networks with a very small amount of nanotubes compared to other conventional methods, thereby strongly reducing materials costs.

In a previous study (*Applied Physics Letters*, Volume 103, Issue 2, 021116 (2013)) the research team of David R. Barbero already demonstrated that nano-engineered networks can be produced onto thin and flexible transparent electrodes that can be used in flexible solar cells. These new results are expected to accelerate the development of next generation of flexible carbon based solar cells, which are both more efficient and less expensive to produce.

More information: "Nano-engineering of SWNT networks for enhanced charge transport at ultralow nanotube loading." D. R. Barbero, N. Boulanger, M.

Ramstedt, Department of Chemistry, Umeå University, J. Yu, Department of Physics, Umeå University . *Advanced Materials*. DOI: 10.1002/adma.201305718.