Tiny Towers: Carbon Nanotube Structures Could Provide More Efficient Solar Power for Soldiers

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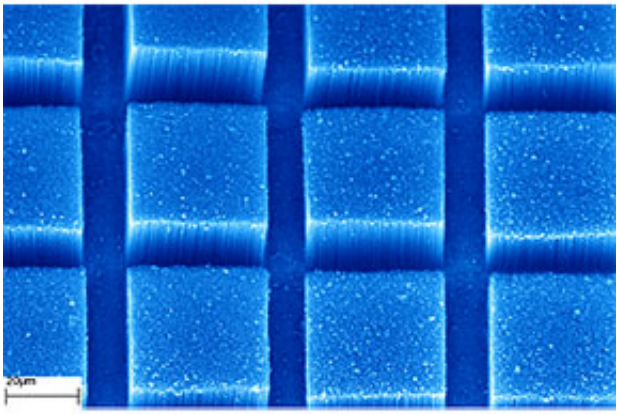

When residents of New York's Manhattan Island ran out of real estate for new construction, they expanded vertically – using multi-story buildings to get more living space on their compact island. Scientists at the Georgia Tech Research Institute (GTRI) hope to follow their example, but on a nanometer scale – building carbon nanotube towers atop photovoltaic cells to extract more power from the sun.

The nanometer-scale scale towers, which would be coated by the special p-type and n-type semiconductor (p/n) junction materials used to generate electrical current, would increase the surface area available to produce electricity.

Reflections off the Gothamesque towers would provide more opportunity for each photon of sunlight to interact with the p/n junction of the cell. That would increase the power output from PV cells of a given size, or allow cells to be made smaller while producing the same amount of power.

For soldiers operating in the field, especially in desert areas that receive lots of sunlight, the new “solar tube” cells could provide an alternate power source for the growing number of electronic devices they use. Without the need for trucking in fuel, compact PV cells could directly power certain applications or be used to recharge batteries in soldiers’ equipment.

“You will typically get low voltages from the sun, but it generates a steady state supply -- like a fuel cell – but without the need for a consumable fuel,” explained Jud Ready, a research engineer in GTRI's Electro-Optics, Environment and Materials Laboratory (EOEML) who is the project’s principal investigator. “It would certainly be viable for recharging and for supplying power to a base where people are stationed long-term. This could have significant benefits from a supply logistics standpoint.”

The three-dimensional cells could also be useful in space applications, where power is in constant demand and launch weight is critical. Ultimately, they also could be used in developing nations where low-cost electrical power is vital to expanding economies.

The researchers have already developed techniques for precisely growing

carbon nanotube bundles atop silicon wafers that have been treated with catalysts to produce geometries that resemble three-dimensional nano-models of Manhattan.

The next step will be to work with collaborators at GTRI and the Georgia Tech Schools of Materials Science and Engineering and Electrical and Computer Engineering to apply the n-type and p-type coatings whose junction produces current.

Because their cells will be more efficient, Ready believes they can use older and more mature p/n-type material technologies and less costly silicon wafers to hold down costs and rapidly advance the project into products that can be used in the field.

Challenges ahead include materials compatibility and long-term durability issues. Ultimately, the carbon nanotubes – which are themselves semiconducting at times – could be integrated to replace one or more of the p/n-type layers.

Source: Georgia Institute of Technology