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Coaxial silicon nanowires as solar cells

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Solar cells are attractive candidates for clean and renewable power. With miniaturisation, they might also serve as integrated power sources for nanoelectronic systems. In the pursuit of smaller and more efficient solar cell technology, scientists have made a photovoltaic element two-hundred-times thinner than a hair. A nanowire device reported in this week's Nature could initiate a new generation of solar cells.

The use of nanostructures or nanostructured materials represents a general approach to reduce both cost and size and to improve efficiency in photovoltaics. Nanoparticles, nanorods and nanowires have been used to improve charge collection efficiency in polymer-blend and dye-sensitised solar cells, to demonstrate carrier multiplication, and to enable low-temperature processing of photovoltaic devices. Moreover, recent theoretical studies have indicated that coaxial nanowire structures could improve carrier collection and overall efficiency with respect to single-crystal bulk semiconductors of the same materials. However, solar cells based on hybrid nanoarchitectures suffer from relatively low efficiencies and poor stabilities. In addition, previous studies have not yet addressed their use as photovoltaic power elements in nano-electronics.

The device is a wire made of silicon with three different types of conductivity arranged as shells, like an electric coaxial cable. Incoming light generates electrons in the outer n-type shell, whereas their positive holes are swept into the central p-type layer. Charles M. Lieber and colleagues demonstrate how current drawn from the photovoltaic nanowire can be used to power tiny nanoelectronic circuits.

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