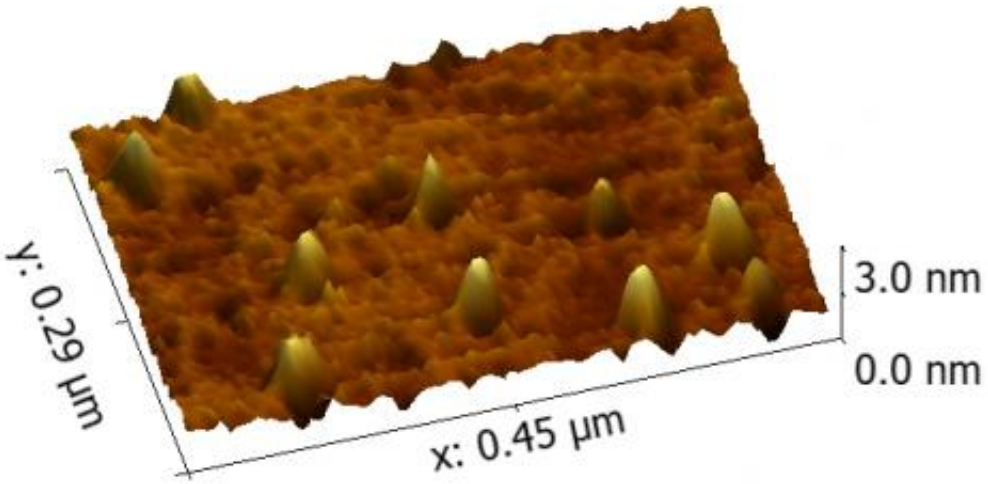
# Countdown to zero: New 'zero-dimensional' carbon nanotube may lead to superthin electronics and synthetic cells

December 9 2013, by Paul Kovach




Piles of zero-dimensional carbon nanotubes appear as gold “mountains” on a substrate by atomic force microscopy. The nanotube mountains are only a few nanometers high – or nearly a billion times smaller than an inch. Credit: University of Pittsburgh Swanson School of Engineering

(Phys.org) —Synthetic, man-made cells and ultrathin electronics built from a new form of "zero-dimensional" carbon nanotube may be possible through research at the University of Pittsburgh Swanson School of Engineering. The research, "Zero-Dimensional" Single-Walled

Carbon Nanotubes," was published in the journal *Angewandte Chemie*.

Principal investigators are Steven R. Little, PhD, associate professor, CNG Faculty Fellow and Chair of the Department of Chemical and Petroleum Engineering; and Anna C. Balazs, PhD, the Distinguished Robert v. d. Luft Professor of Chemical and Petroleum Engineering. Co-investigators include Riccardo Gottardi, PhD, Ri.MED Foundation Fellow, whose research focuses on nanotechnology and biomedical engineering; Alexander Star, PhD, associate professor of chemistry; Bhaskar Godugu, PhD, research assistant professor and director of Pitt's mass spectrometry facility; Susheng Tan, PhD, research assistant professor; postdoctoral researchers Yanan Chen, PhD and Kaladhar Kamalasanan, PhD; and Sam Rothstein, PhD, CSO and co-founder of Qrono Inc.

"Since its discovery, carbon nanotubes have held the promise to revolutionize the field of electronics, material science and even medicine," says Dr. Little. "Zero-dimensional carbon nanotubes present the possibility to build ultrathin, superfast electronic devices, far superior to the best existing ones and it could be possible to build strong and ultralight cars, bridges, and airplanes."

One of the most difficult hurdles is processing the carbon nanotubes into smaller forms. However, previous research at Pitt has managed to cut the carbon nanotubes into the smallest dimensions ever to overcome this problem.

"We have confirmed that these shorter nanotubes are more dispersible and potentially easier to process for industrial as well as biomedical application, and could even constitute the building blocks for the creation of synthetic cells," says Dr. Gottardi.

The organization of the atoms within nanotubes makes them particularly

interesting materials to work with. However, they are barely soluble, making industrial processing difficult. One aspect of the team's research will focus on creating more soluble and therefore more usable carbon nanotubes. These shorter nanotubes have the same dimensions as many proteins that compose the basic machinery of living cells, presenting the potential for cell or protein-level biomedical imaging, protein or nucleic acid vaccination carriers, drug delivery vehicles, or even components of synthetic cells.

Overall, the project is aimed at developing and working with these more dispersible carbon nanotubes with the aim of making them easier to process. The creation of the smaller nanotubes is the first step toward reaching this goal.

**More information:** Research paper: onlinelibrary.wiley.com/doi/10 … e.201305526/abstract

Provided by University of Pittsburgh Swanson School of Engineering

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