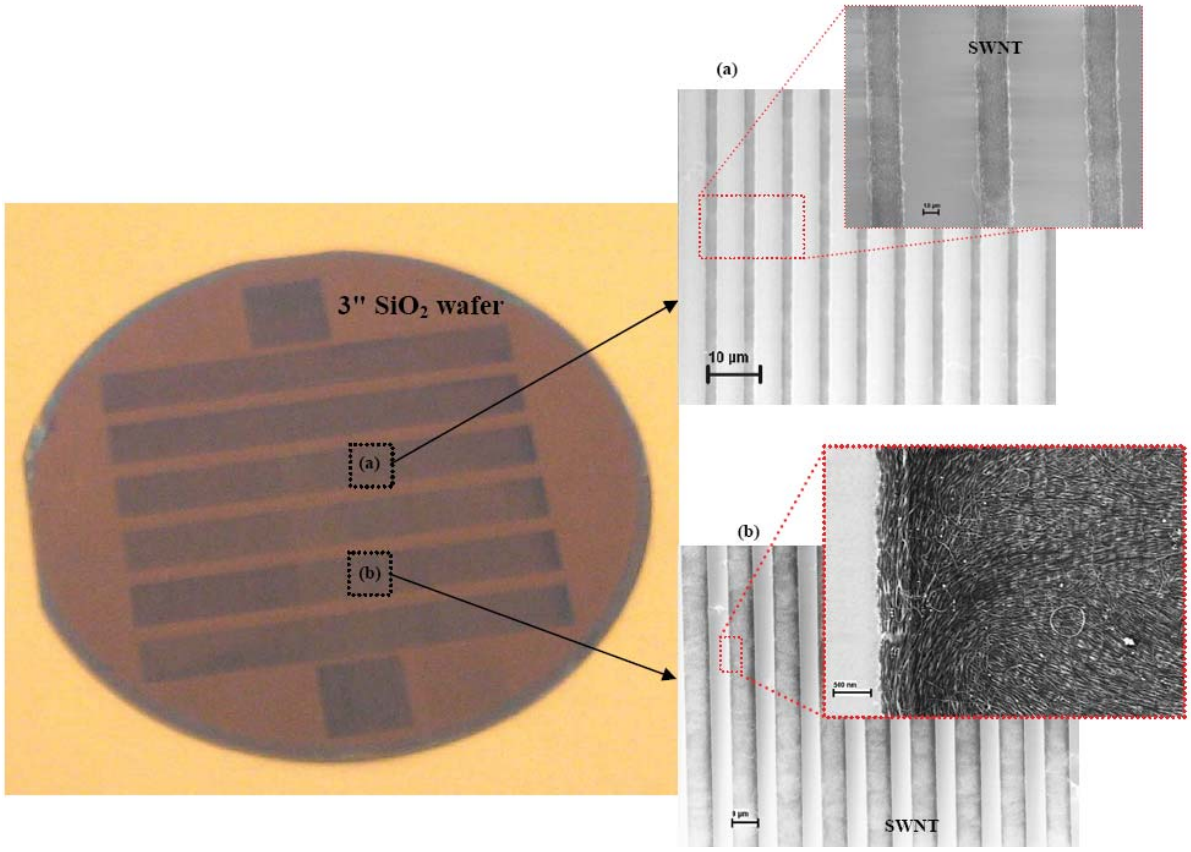
Large-Scale Nanomanufacturing of Complex Single-Walled Nanotube Architectures

Given the larger number of potential applications for carbon nanotubes, there is an urgent need for developing effective ways to mass produce intricate nanoscale structures for many applications in a timely, cost-effective manner with a high level of accuracy.

Researchers at the Center for High-rate Nanomanufacturing (CHN) at Northeastern University built intricate single-walled nanotube (SWNT) architectures with a high degree of accuracy, laying the foundation for the nanomanufacturing industry to overcome a major obstacle—precise and accurate placement of SWNTs. The researchers used a nanotemplate-guided fluidic assembly process for optimum accuracy and control over the placement of the SWNTs on a silicon wafer. Using this fluidic assembly process for the SWNT assembly enabled a highly controlled environment at the nanoscale. A wafer surface treatment made SWNTs highly attracted to the surface and enabled building highly organized SWNT architectures in various dimensions and geometries. This assembly method can be extended to scales as small as a few nanometers while the length of the architecture is scalable up to 12-inch wafers.

This novel process helps us better understand the fundamental mechanism governing assembly of SWNTs, and it finally makes possiblebuilding large-scale (wafer-level) nanoscale structures and networks of single-walled nanotubes . The potential applications of these complex structures include transistors, horizontal interconnect systems, complex SWNT-based materials for nanoelectronics, sensors, batteries, photovoltaics, and medical and biotechnology applications.



SEM images of the assembled SWNT structures on a 3 inch wafer with pattern widths of (a) 3 µm, and (b) 9 µm structures of assembled SWNTs.

Jaber-Ansari, L., M.G. Hahm, S. Somu, Y. E. Sanz, A. A. Busnaina and Y.J Jung, *Journal of the American Chemical Society*, 2009, **131** (2): 804–808 (published online December 18, 2008).

Patents or other steps toward commercialization : X. Xiong, A. A. Busnaina, Y. J. Jung, L. Jaberansari, S. Somu, M. Upmanyu, "Building highly organized single-walled carbon nanotube networks using template guided fluidic assembly," U.S. Provisional Patent Application No. 61/199,724.

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