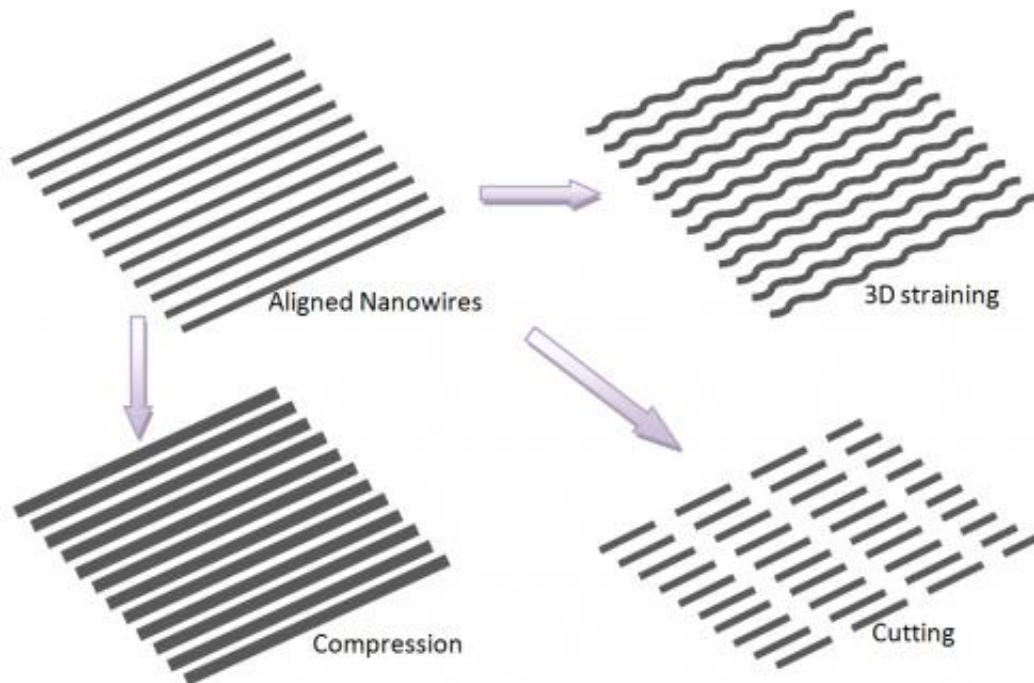


# 'Nano machine shop' shapes nanowires, ultrathin films

August 29 2012, by Emil Venere



This illustration depicts a new "nano machine shop's" ability to shape tiny wires, an advance that represents a possible future manufacturing method for tiny structures with potentially revolutionary properties. Credit: Gary Cheng, Purdue University

(Phys.org)—A new "nano machine shop" that shapes nanowires and ultrathin films could represent a future manufacturing method for tiny structures with potentially revolutionary properties.

The structures might be "tuned" for applications ranging from high-speed electronics to [solar cells](#) and also may have greater strength and unusual traits such as ultrahigh magnetism and "plasmonic resonance," which could lead to improved optics, computers and electronics.

The researchers used their technique to stamp nano- and microgears; form tiny circular shapes out of a material called graphene, an ultrathin sheet of carbon that holds promise for advanced technologies; and change the shape of silver nanowires, said Gary Cheng, an associate professor of industrial engineering at Purdue University.

"We do this shaping at room temperature and [atmospheric pressure](#), like a nano-machine shop," said Cheng, working with doctoral students Ji Li, Yiliang Liao, Ting-Fung Chung and Sergey Suslov and physics professor Yong P. Chen.

Graphene and nanowires – filaments 1,000 times thinner than a [human hair](#) – have numerous potential applications. However, technologies are needed to tailor them for specific uses. The new method, called laser shock-induced shaping, makes it possible to tune nanowires by altering electrical and optoelectrical properties critical for electronic components and instruments.

The researchers also have shown how laser shock-induced shaping can be used to change the properties of graphene, a step toward harnessing the material for [electronic applications](#).

Findings were detailed in research papers published in the journal [Nano Letters](#), and the work also was highlighted earlier this month in the News and Views section of the journal [Nature Photonics](#).

The technique works by using a multilayered sandwich structure that has a tiny mold at the bottom. Nanowires were situated directly above the

mold, and other materials were layered between the nanowires and a glass cover sheet. Exposing this layered "forming unit" to an ultra-fast pulsing laser causes one of the layers to burn up, generating a downward pressure that forces the nanowires into the mold and changing their shape.

"The process could be scaled up for an industrial roll-to-roll manufacturing process by changing laser beam size and scanning speed," Cheng said. "The laser shock-induced shaping approach is fast and low-cost."

Part of the research, funded by the National Science Foundation, was carried out in a specialized clean room at the Birck Nanotechnology Center in Purdue's Discovery Park.

**More information:** Nanoscale Strainability of Graphene by Laser Shock Induced 3D Shaping, [www.nature.com/nphoton/journal ... photon.2012.186.html](http://www.nature.com/nphoton/journal...photon.2012.186.html)

Provided by Purdue University

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