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Science news

# Simple, cheap way to make silicon nanowires

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A simple and economical new process to synthesize crystalline silicon nanowires (SiNWs) could turn out to be a boon for large-scale commercial production of electronic devices, including photovoltaic solar cells<sup>1</sup>.

These quasi-one-dimensional nanowires have attracted much research interest in the past decade due to their exceptional physical properties. They have wide potential applications including in high performance field effect transistors, nano electromechanical systems, high performance lithium battery anodes and photovoltaic devices.

Scientists have used catalysts to grow SiNWs in the past. Only a few have reported catalyst-free growth of SiNWs. Many methods have been developed to grow SiNWs but a universal growth technique that fulfills all requirements for potential applications has not yet emerged.

Current methods to grow nanowires — chemical vapour deposition, molecular beam epitaxy, laser ablation and silicon monoxide (SiO) evaporation — require the use of sophisticated and costly equipment and toxic materials including silane (SiH<sub>4</sub>), disilane (Si<sub>2</sub>H<sub>6</sub>) and dichlorosilane (SiH<sub>2</sub>Cl<sub>2</sub>).

A team from Gujarat Energy Research and Management Institute (GERMI), Gandhinagar in collaboration with researchers from Pandit Deendayal Petroleum University (PDU), Gandhinagar and University of Saskatchewan in Canada seem to have overcome these hurdles. They have come up with a simple, single step technique for large-scale applications — they synthesized the nanowires by simply oxidizing and then reducing silicon wafers in a high temperature furnace.

"Using this technique, SiNWs can be synthesized on silicon substrate without any additional nano-sized metal catalyst seed layer," Sanjay Behura, principal author of the paper, explained to *Nature India*. Compared to previous methods, this has many advantages: it eliminates metal catalyst contamination, avoids the use of toxic precursor gases (such as SiH<sub>4</sub> or SiCl<sub>4</sub>) and doesn't require transfer of the nanowires for device manufacturing as they are grown directly on silicon wafers.

"The technique is easy to scale up and eliminates the use of metal catalysts, toxic gases and costly equipment, thus holding great potential for practical applications," the researchers said.

The nanowires synthesized by Behura and colleagues consist of a crystalline core of approximately 25 nm (one nm is one billionth of a metre) with a high length-to-diameter ratio (or aspect ratio) of 167. That is a desirable property of nanoparticles for industrially important applications, they claim.

## References

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1. Behura, S. K. *et al.* Catalyst-free synthesis of silicon nanowires by oxidation and reduction process. *J. Mater. Sci.* doi: [10.1007/s10853-013-7476-5](https://doi.org/10.1007/s10853-013-7476-5)

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