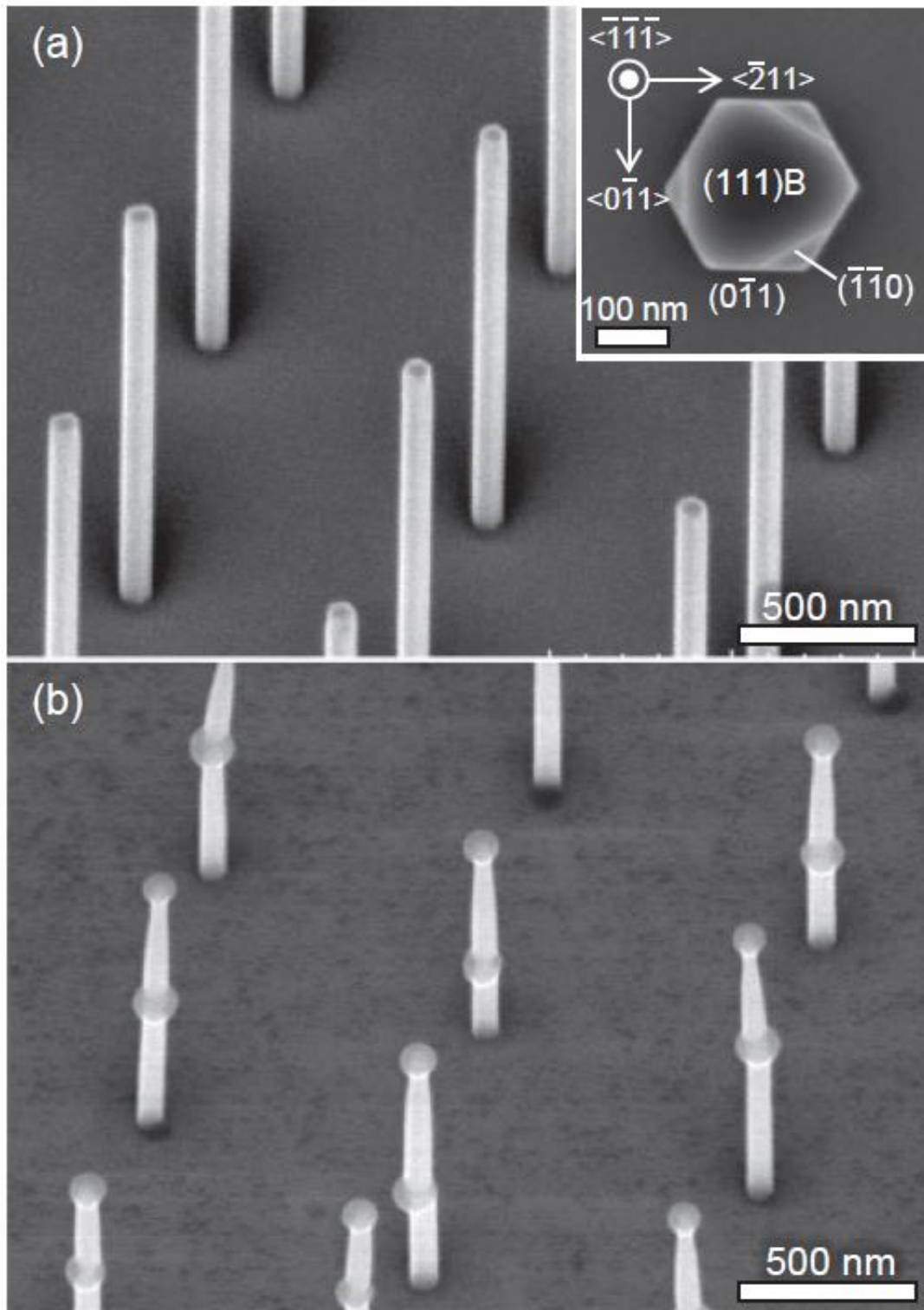


A novel method of making high-quality vertical nanowires

August 29 2016



Researchers in Japan have developed a novel way of growing high quality ferromagnetic nanowires in and on semi-conducting nanowire templates. Electron micrograph (a) shows a typical InAs nanowire template array, and (b) a

heterojunction MnAs/InAs nanowire array. The ferromagnetic nanowires grow either inside (in the middle) or on top of the semiconducting nanowires, providing interesting electronic properties for future applications. Credit: Japan Society of Applied Physics (JSAP)

Researchers at Hokkaido University describe a novel method of making high quality vertical nanowires with full control over their size, density and distribution over a semi-conducting substrate. The findings are reported in the *Japanese Journal of Applied Physics*.

Nanowires hold interesting properties that are not found in bulk materials, making them useful in components for novel electronic and photonic devices. There is much interest in the development of vertical, free-standing nanowires, as their versatility shows great promise. However, most current designs use bottom-up fabrication techniques that result in vertical nanowires being randomly distributed on semi-conducting substrates, limiting their usability.

Now, Ryutaro Kodaira, Shinjiro Hara and co-workers at Hokkaido University have demonstrated a novel method of making high quality vertical nanowires with full control over their size, density and distribution over a semi-conducting substrate.

The team created an indium arsenide (InAs) nanowire template from which to grow the desired heterojunction nanowires, which were composed of ferromagnetic manganese arsenide (MnAs) and [semiconducting](#) InAs. In the fabrication process, they first produced the InAs nanowire template by precisely patterning circular openings in silicon dioxide thin films, which were deposited by plasma sputtering onto wafers. Next the researchers grew single InAs nanowires in each circular hole. The MnAs nanowires formed either inside (in the middle)

or on top of the InAs nanowires, by a process known as 'endotaxy' – orientated crystal growth inside another crystal.

The MnAs nanowires had a hexagonal structure, exhibiting no defects or dislocations, and no contamination with other elements. The interface between the semi-conducting InAs nanowires and the ferromagnetic MnAs nanowires provides interesting possibilities for future devices. Indeed, Kodaira and Hara's team have already been using their new nanowires to carefully characterize magnetotransport properties of the nanowires for the potential fabrication of vertical spintronic device applications.

The nanowires could prove invaluable in next-generation sensing devices for electronic, photonic and bio-chemical applications. The new nanowires created by the team could widen the versatility of the [nanowires](#) to even nano-scale spintronics.

More information: Ryutaro Kodaira et al. Synthesis and structural characterization of vertical ferromagnetic MnAs/semiconducting InAs heterojunction nanowires, *Japanese Journal of Applied Physics* (2016). [DOI: 10.7567/JJAP.55.075503](https://doi.org/10.7567/JJAP.55.075503)

Provided by Japan Society of Applied Physics

Citation: A novel method of making high-quality vertical nanowires (2016, August 29) retrieved 25 April 2024 from <https://phys.org/news/2016-08-method-high-quality-vertical-nanowires.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.