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Hexagonal Ge on self-assisted GaAs Nanowires for light emission

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Abstract :

The recent demonstration of direct band gap emission in hexagonal Ge is attracting great interest in the field of optoelectronics. So far, hexagonal (Si)Ge have been fabricated by epitaxial growth on the facets of wurtzite GaAs or GaP nanowires [1].

In our work, hexagonal Ge has been grown on the facets of self-assisted GaAs nanowires by MBE using VLS mechanism [2]. An extended pure wurtzite segment was maintained by tuning the V/III ratio to appropriate values [3]. Following the growth of the GaAs core, a Ge shell has been grown with a long hexagonal segment. The crystal structure of the nanowires has been characterized with high-resolution scanning transmission electron microscopy (STEM) and dark field transmission electron microscope (TEM). The Ge surface chemistry was studied by X-ray photoelectron spectroscopy (XPS) showing a strong As contamination that can be decreased by tuning some growth parameters.

Photoluminescence spectroscopy (PL) was performed to investigate the optical properties of the hexagonal Ge phase. Furthermore, the quantum confinement can be achieved in hexagonal Ge, leading to a blueshift of the emission.

References:

[1] Fadaly, E.M.T. *et al.* (2020). Nature, 580, 205.

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[3] Dursap, T. (2021). Wurtzite phase control for self-assisted GaAs nanowires grown by molecular beam epitaxy. Nanotechnology, 32, 155602.

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