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Telecom band light emission from confined hexagonal Ge grown on self-assisted GaAs NWs by MBE

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In this work, hexagonal germanium (hex-Ge) was grown on the facets of self-assisted GaAs nanowires by MBE using VLS mechanism [1]. A pure wurtzite segment was maintained by adjusting the V/III ratio [2]. After growing GaAs core, Ge shell was grown with a long hexagonal segment. The crystal structure was characterized using high-resolution scanning transmission electron microscopy to confirm the presence of hex-Ge.

We focused our investigations on the start of hex-Ge growth on GaAs nanowire facets. Measurements by atom probe tomography (APT) and high-resolution transmission electron microscopy (TEM) allow us to conclude that hex-Ge growth starts with the formation of small quantum dots (QDs) [Figure 1.a], which then expand until coalescing to form a radial quantum well. Photoluminescence (PL) spectroscopy performed on these hex-Ge/GaAs heterostructures shows a strong quantum confinement in these QDs leading to a light emission in the telecom bands. A redshift of the PL emission is observed when the QD size increases along with a strong decrease of the PL emission when the QD coalescence begins [Figure 1.b].

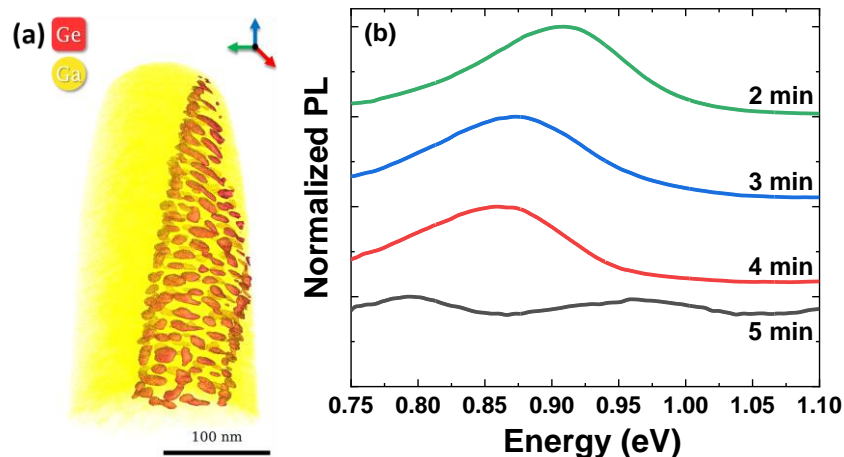


Figure 1: (a) APT showing small QDs. (b) low temperature PL as a function of the Ge growth duration in min.

[1] I. Dudko, *Cryst. Growth Des.* **22**, 32-36(2021).

[2] T. Dursap, *Nanotechnology* **32**, 155602(2021).

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