C2N General Seminar

Friday March 1st 2019 - 10h 00

Amphitheater of C2N

Real time TEM observation of semiconductor nanowire growth

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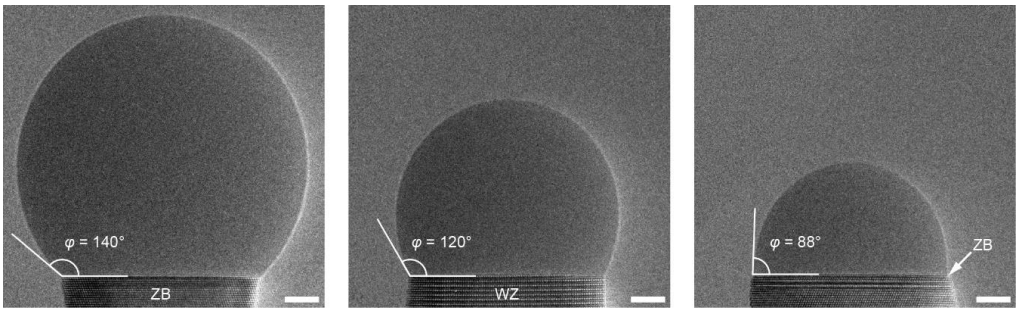
Synthetizing III-V semiconductor nanowires (NWs) using the vapour-liquid-solid (VLS) method can result in the growth of crystal structures different from their bulk phase. In GaAs NWs, for example, the stable phase zinc-blende (ZB) coexists with the metastable wurtzite (WZ) structure. Remarkably, the valence and conduction bands are misaligned in the two phases, so that small sections of one phase within the other effectively confine charge carriers along the wire axis. Therefore, the possibility of controllably switching between phases opens up opportunities to create novel heterostructures commonly identified as crystal phase quantum dots (CPQD). In contrast to compositional heterojunctions, crystal phase heterostructures have the intrinsic property of minimizing residual strain and alloy intermixing at interfaces.

In this talk, I will present experimental observations of the growth of Ga-As nanowires obtained using a transmission electron microscope (ETEM) equipped with molecular-beam-epitaxy (MBE) sources. NWs are grown directly inside the microscope and their growth is monitored *in situ* and in real time with high spatial and temporal resolution. I will show that thanks to these new insights we can precisely dictate the crystal phase and diameter of nanowires in order to synthetize CPQD with unprecedented control on their size and position along the wire axis. I will then discuss the opportunities that this novel family of structures opens up for the fabrication of single photon emitters and other photonic devices.



TEM images showing the impact of the droplet aspect ratio on the crystal structure of self-catalyzed GaAs NWs.

Federico Panciera joined the department of electrical engineering at the University of Cambridge in 2013 as a post-doctoral Research Associate. At the same time, he was a regular Visitor Scientist at the IBM T. J. Watson Research Center in New York where he investigated the growth of nanocrystals using *in situ* TEM. He successively spent one year as Research Fellow at the National University of Singapore where he developed MEMS based samples and novel image analysis techniques for *in situ* experiments. In 2018, he joined the department of material science of C2N – ELPHYSE group – as a CNRS researcher. His current interested is in understanding the mechanisms of nanowire growth in order to synthetize novel nanostructures for applications in energy harvesting, photonics and electronics

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