Occurrence and color of single-photon emitters nested in the shell of GaAs/AlGaAs nanowires

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Despite its undisputed advantages, GaAs suffers from very poor surface properties. In order to fully harness the potential of GaAs nanowires (NWs), a common dodge consists in capping the GaAs core with a $Al_xGa_{(1-x)}As$ shell. Interestingly, there is a recent revival of interest for AlGaAs shell and AlGaAs/GaAs heterointerfaces. In the last year, several groups presented results providing details on AlGaAs shells and sometime revealing unexpected behaviors [1-2].

Quantum dots (QDs) enclosed in the shell of AlGaAs/GaAs core-shell NWs grown with molecular beam epitaxy (MBE) were recently put in evidence [3]. The QDs formation is driven by the different mobilities of Al and Ga adatoms on the NWs side facets. A similar mechanism is responsible for the apparition of Al-rich planes dividing the facets of AlGaAs shells [1]. In our case, the novelty resides in the identification of Ga-rich islands arising from these planes. The nanometric Ga-rich regions are able to efficiently confine carriers. In this study we show that the emission spectral distribution can be extended and shifted depending on the growth condition (figure 1). We further investigate with cathodoluminescence microscopy the location of the emitters within the shell in order to gain knowledge on the formation of such quantum dots (figure 2).

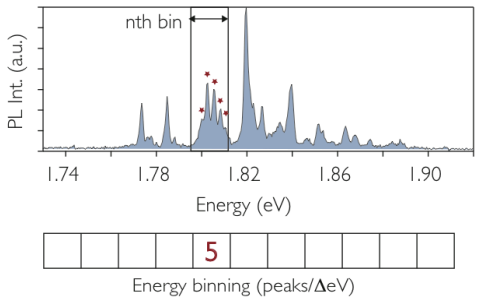

Figure 1: Spectral distribution of light emitters

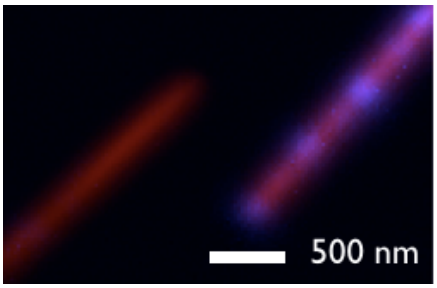

Figure 2: Spatial location of QDs in NWs

[1] C. Zheng *et al.*, *Nano Lett.*, **13**, 3742–3748, (2013)

[2] M. Hocevar *et al.*, *Appl. Phys. Lett.*, **102**, 191103, (2013)

[3] M. Heiss *et al., Nat. Mater.*, **12**, 439−444, (2013)