GaP/GaAs AXIAL HETEROSTRUCTURES IN SELF-CATALYZED NANOWIRES

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$GaAs_{1-x}P_x$ nanowires (NWs) have potential applications in photovoltaics and photonics, thanks to the possibility to adjust their group V composition and thus the band gap, over a wide range. Self-catalyzed NWs are grown using a droplet made of the group III element. This avoids contamination from foreign materials and opens new possibilities such as diameter tailoring. While the self-catalytic method of growing GaAs NWs has attracted much attention in the recent years, its extension to other Ga-V semiconductors has rarely been investigated, especially concerning the fabrication of *axial* heterostructures[1,2]. Here, we present the self-catalyzed growth of pure GaP NWs by molecular beam epitaxy, using growth conditions compatible with those used for GaAs NWs. By commuting the group V fluxes, we fabricate purely axial GaP/GaAs heterostructures, composed of multiple and reproducible segments of binary and ternary compounds. We test different flux switching schemes and measure the corresponding interfacial composition profiles with atomic resolution, using high-angle annular dark field (HAADF) scanning transmission electron microscopy. We show that the interface abruptness is drastically improved by switching off all the molecular fluxes for a short time at the group V commutation. Finally, we demonstrate that the morphology of the growth front can be either flat or truncated, depending on the growth conditions.

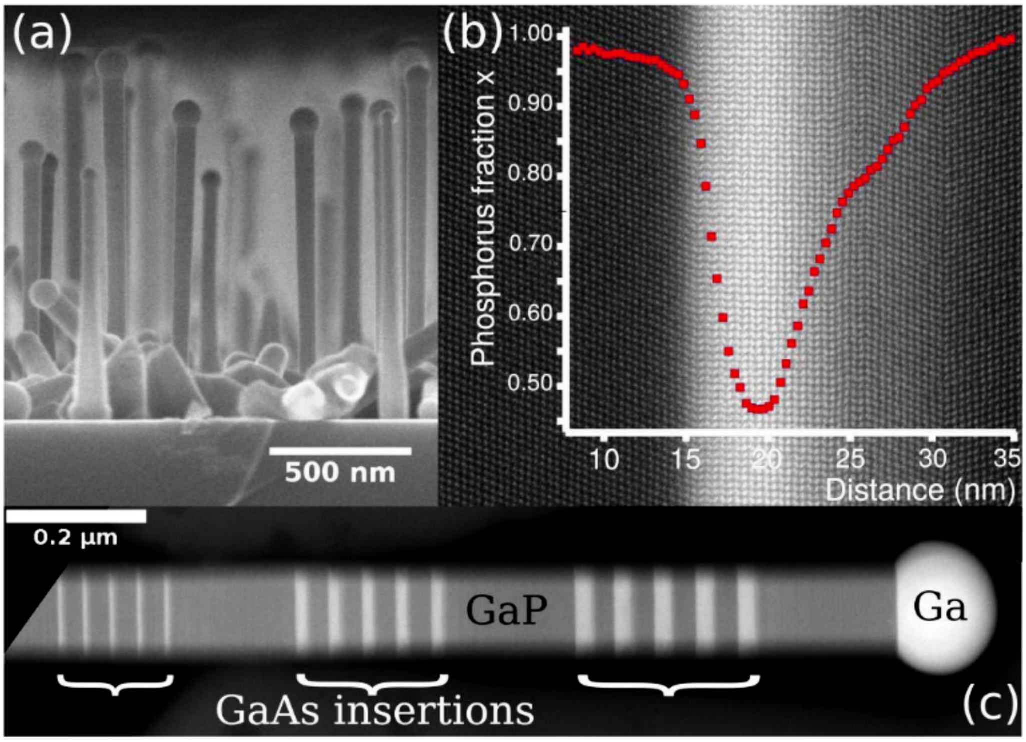

Figure 1: a) Pure self-catalyzed GaP NWs grown on Si(111); b) Example of compositional profile extracted from a high-resolution HAADF TEM image; c) Medium-resolution HAADF TEM image showing GaAs insertions in a GaP NW.

References

[1] Y. J. Kuang, *et al.*, *Appl. Phys. Lett*. **100**, 053108 (2012).

[2] Y. Zhang, *et al.*, *Nano Lett.* **13**, 3897 (2013).

[3] G. Priante, *et al.*, *submitted*