

Supporting Information

Structural and spectroscopy characterization of coaxial GaAs/GaAsSb/GaAs single quantum well nanowires fabricated by molecular beam epitaxy

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Section 1. Diameter distribution of SQW nanowires.

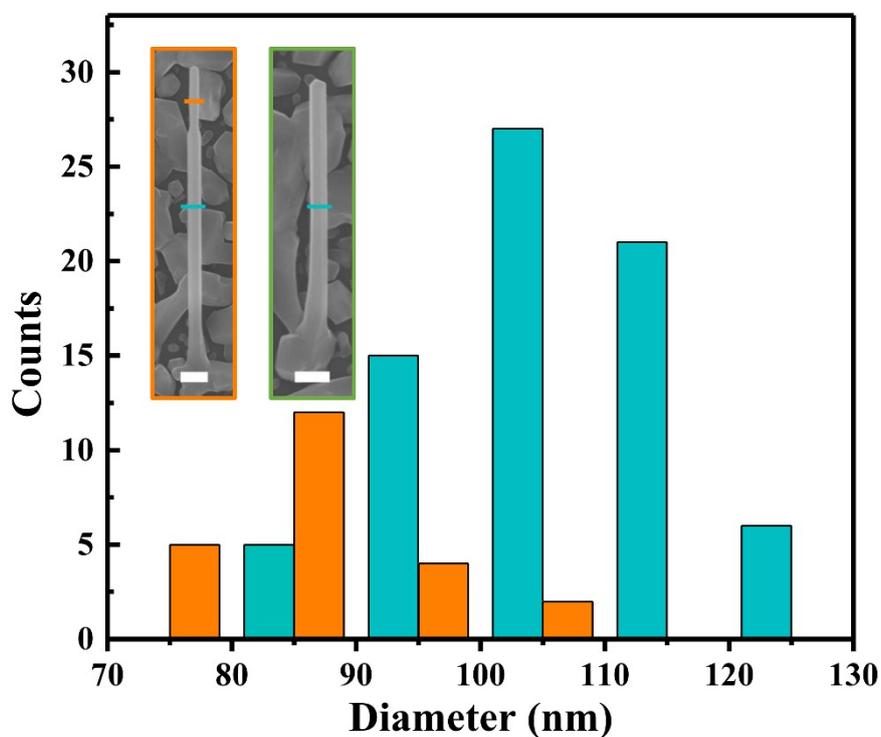


Figure S1. The statistical distribution of the diameter of the nanowires: the orange histogram of the figure is the statistical distribution of the diameter of the A-type

nanowires tip; the cyan histogram represents the diameter of the B-type nanowires and non-tip of the A-type nanowires. Scale bars in the inset are 100 nm and 200 nm, respectively.

The statistical distribution of the nanowires diameter is shown in Figure S1. We can observe that the diameter of the non-tip of the A-type nanowire is consistent with the B-type nanowire, and its value is about 100 nm. The uniform diameter of the nanowires indicates that the atoms can diffuse to the top of the nanowires by thermal migration during VS growth, otherwise the nanowires will have a tapered structure. The diameter of the tip of the A-type nanowire becomes smaller, around 80 nm.

Section 2. SEM image of previously grown GaAs nanowires.

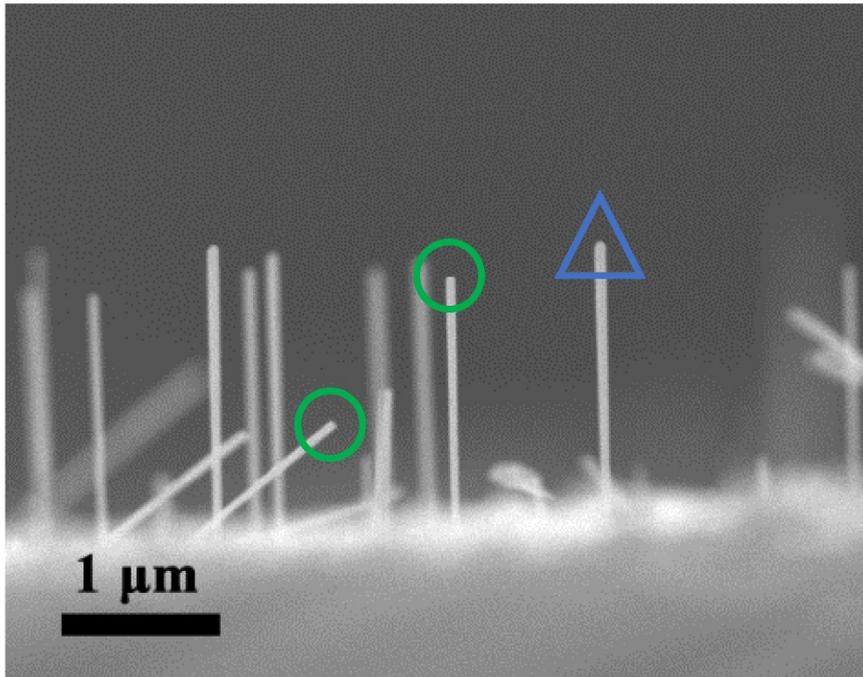


Figure S2. Side-view SEM image of GaAs nanowires grown directly on Si (111) substrates.

The GaAs nanowires were fabricated directly on n-type Si (111) substrate using the self-catalyzed in a DCA P600 SS-MBE system. Degassing of Si (111) substrate is consistent with that described in the text. Ga droplet was deposited for 35 s at 580 °C. And the Ga beam

equivalent pressure (BEP) was 7.1×10^{-8} Torr. V/III flux ratio of 22.5. Nanowires were grown at 580 °C for 30min.

From the Figure S2 we can clearly distinguish the Ga droplets at the top of the nanowires and the flatter growth front. Marks are shown in the figure. According to the results of the GaAs nanowires reported by Yu¹ and the GaAsSb nanowires reported by Li² at different VIII flux ratios. This means that after the nanowires ended up growing under As protection, the Ga droplets at the top of some nanowires were not completely consumed. Eventually Ga forms at the top of the nanowires, consistent with growth of GaAs nanowires via a self-catalyzed VLS mechanism. The Ga droplets at the top of other nanowires were exhausted, thus forming a flatter or tapered tip. This provides a guarantee for the interpretation of the formation of a-type nanowires in the text. The two types of nanowires shown in the TEM can also be used to determine that the top of the former is a fully consumed Ga droplet, while the latter is depleted.

References:

1. X. Yu, H. Wang, J. Lu, J. Zhao, J. Misuraca, P. Xiong and S. von. Molnár, *Nano Letters.*, 2012, **12**, 5436-5442.
2. L. Li, D. Pan, Y. Xue, X. Wang, M. Lin, D. Su, Q. Zhang, X. Yu, H. So, D. Wei, B. Sun, P. Tan, A. Pan, J. Zhao, *Nano Letters.*, 2017, **17**, 622-630.