

Supporting Information

Embedded high-quality ternary GaAs_{1-x}Sb_x quantum dots in GaAs nanowires by molecular-beam epitaxy

Xiyu Hou^{1,2}, Lianjun Wen¹ Fengyue He^{1,2}, Ran Zhuo¹, Lei Liu¹, Hailong Wang^{1,2}, Qing Zhong¹,
Dong Pan^{1,2,†} and Jianhua Zhao^{1,2,†}

¹State Key Laboratory of Superlattices and Microstructures, Institute of Semiconductors,
Chinese Academy of Sciences, P.O. Box 912, Beijing 100083, China

²College of Materials Science and Opto-Electronic Technology, University of Chinese Academy
of Sciences, Beijing 100049, China

† Correspondence to: Dong Pan and Jianhua Zhao, Email: pandong@semi.ac.cn; jhzhao@semi.ac.cn

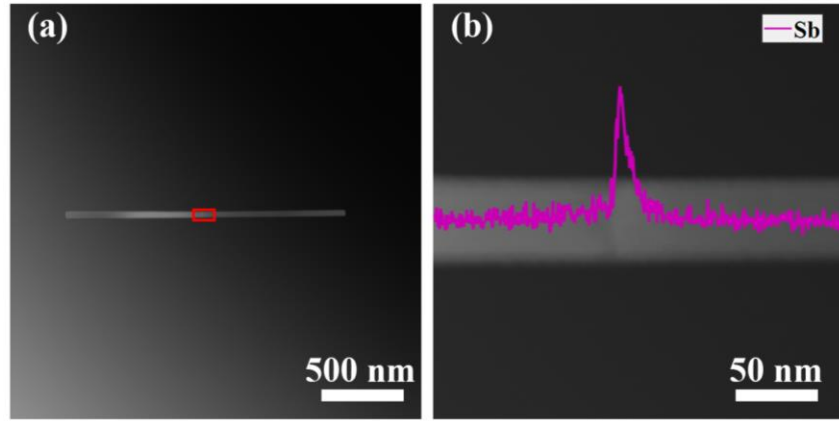


Fig. S1. (a) HAADF-STEM image of the GaAs nanowire with an embedded $\text{GaAs}_{0.8}\text{Sb}_{0.2}$ quantum dot (Sb supply time is 12 s); (b) HAADF-STEM image and EDS line scan taken from the red rectangular region in panel (a).

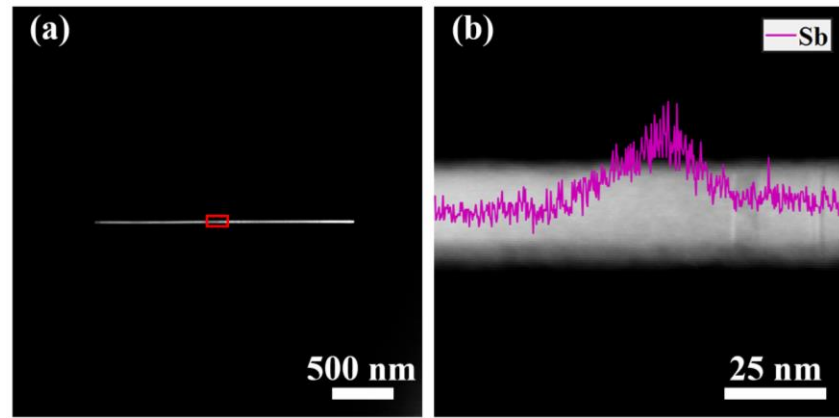


Fig. S2. (a) HAADF-STEM image of the GaAs nanowire with an embedded $\text{GaAs}_{0.85}\text{Sb}_{0.15}$ quantum dot (Sb supply time is 20 s); (b) HAADF-STEM image and EDS line scan taken from the red rectangular region in panel (a).

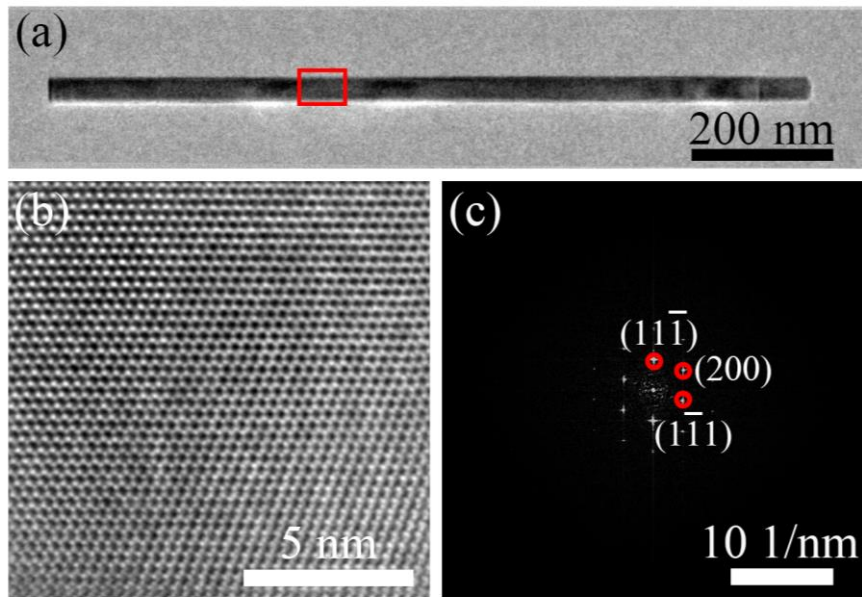


Fig. S3. (a) TEM image of the GaAs nanowire; (b) HRTEM image taken from the red rectangular region in panel (a); (c) The corresponding FFT image of panel (b).

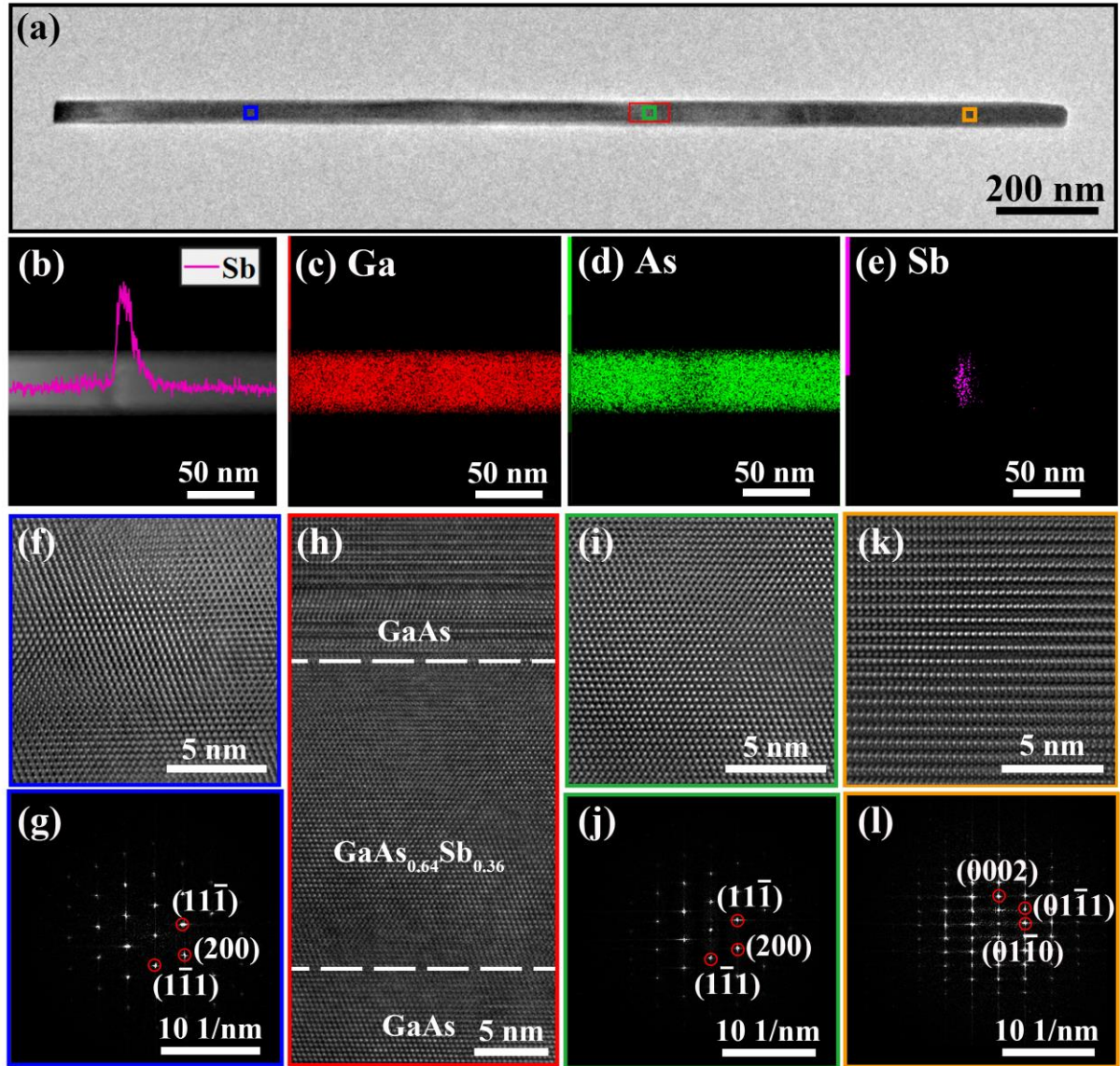


Fig. S4. (a) TEM image of an embedded $\text{GaAs}_{0.64}\text{Sb}_{0.36}$ quantum dot grown at 570 °C. The rectangles in Fig. S4(a) highlight the regions where the HRTEM images were recorded; (b) HAADF-STEM image and the corresponding EDS line scan; (c)-(e) False color EDS maps of the $\text{GaAs}_{0.64}\text{Sb}_{0.36}$ quantum dot; (f) HRTEM image of the bottom GaAs (blue rectangular in panel (a)); (g) The corresponding FFT image of panel (f); (h) HRTEM image of the GaAs/ $\text{GaAs}_{0.64}\text{Sb}_{0.36}$ /GaAs (red rectangular in panel (a)); (i) HRTEM image of the $\text{GaAs}_{0.64}\text{Sb}_{0.36}$ quantum dot (green rectangular in panel (a)); (j) The corresponding FFT image of panel (i); (k) HRTEM image of the upper GaAs (orange rectangular in panel (a)); (l) The corresponding FFT image of panel (k); Compared to the panel (a), panel (f), (h), (i) and (k) were rotated 90 degrees.

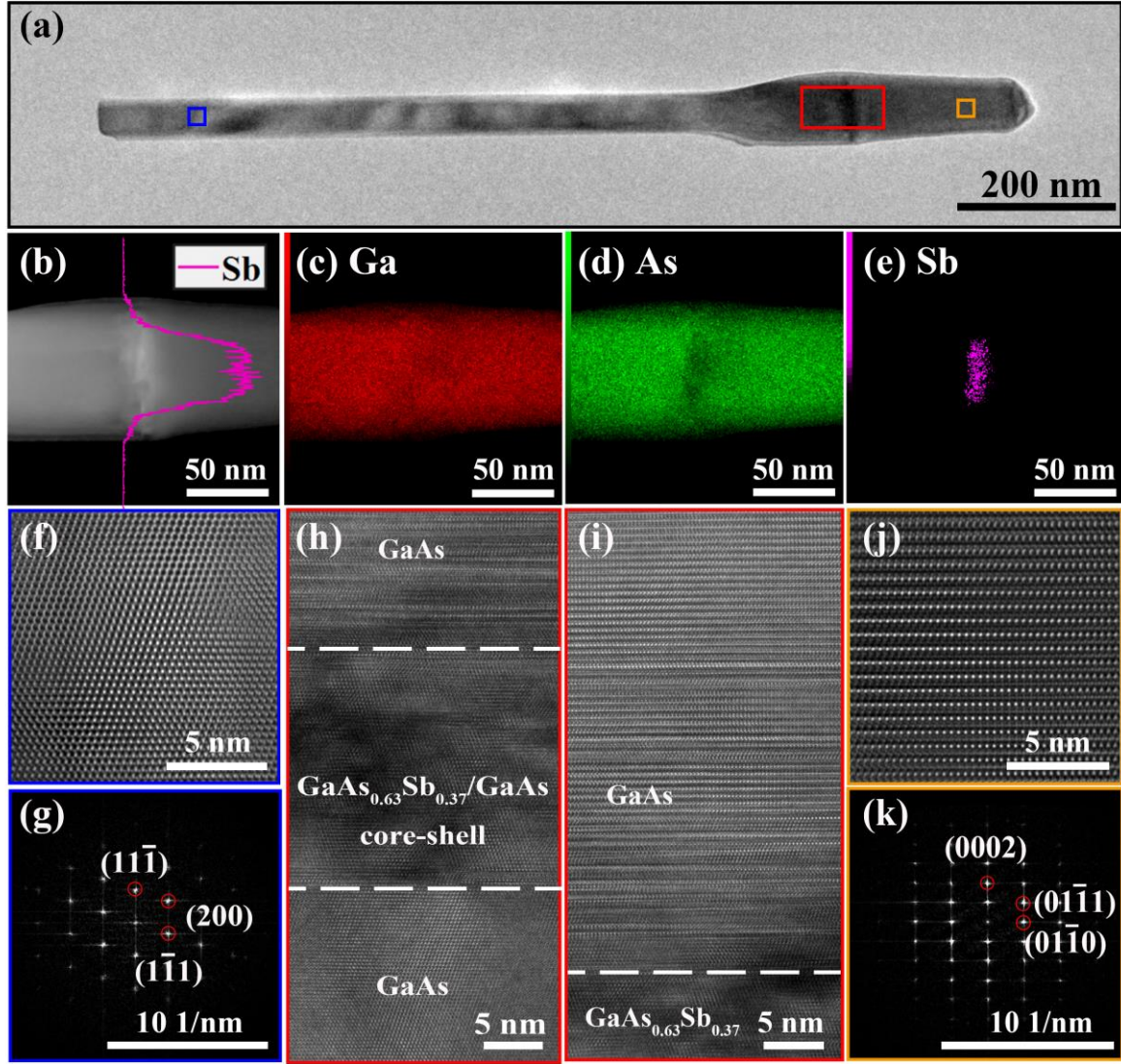


Fig. S5. (a) TEM image of an embedded $\text{GaAs}_{0.63}\text{Sb}_{0.37}$ quantum dot covered with a spontaneous GaAs passivation layer grown at 510 °C. The rectangles in Fig. S5(a) highlight the regions where the HRTEM images were recorded;; (b) HAADF-STEM image and the corresponding EDS line scan; (c)-(e) False color EDS maps of the $\text{GaAs}_{0.63}\text{Sb}_{0.37}$ quantum dot; (f) HRTEM image of the bottom GaAs (blue rectangular in panel (a)); (g) The corresponding FFT image of panel (f); (h) and (i) HRTEM images of the $\text{GaAs}/\text{GaAs}_{0.63}\text{Sb}_{0.37}/\text{GaAs}$ (red rectangular in panel (a)); (j) HRTEM image of the upper GaAs (orange rectangular in panel (a)); (k) The corresponding FFT image of panel (j); Compared to the panel (a), panel (f), (h), (i) and (k) were rotated 90 degrees.

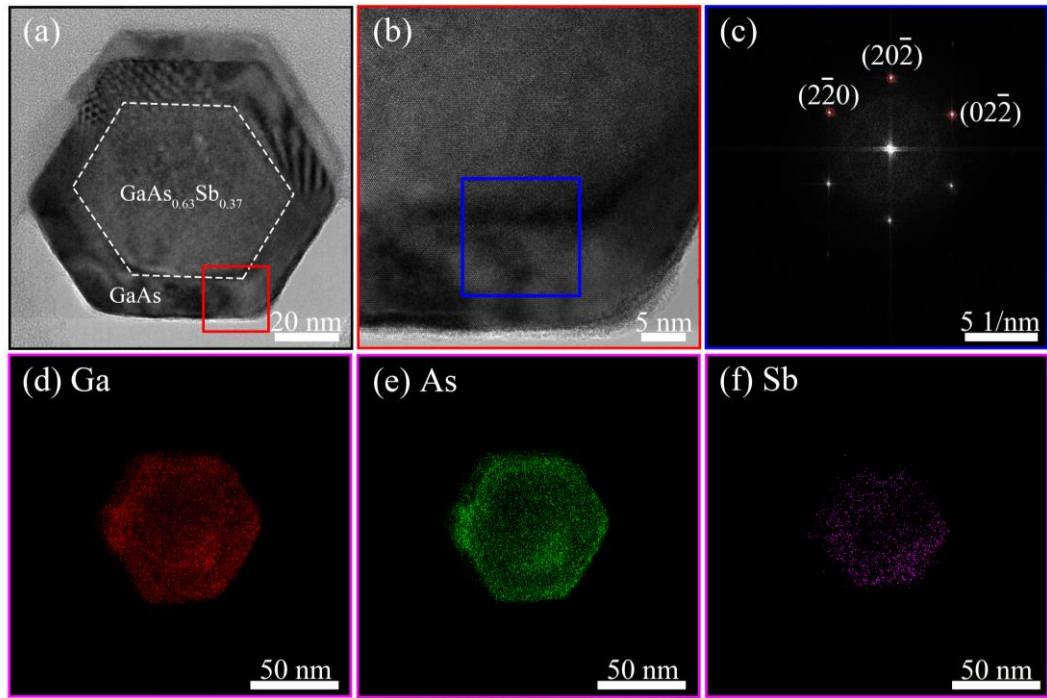


Fig. S6. (a) Cross-section TEM image of an embedded $\text{GaAs}_{0.63}\text{Sb}_{0.37}$ quantum dot covered with a spontaneous GaAs passivation layer grown at 510 °C; (b) HRTEM image taken from the red rectangular region in panel (a); (c) The corresponding FFT image of the blue rectangular region in panel (b); (d)-(f) False color EDS maps of the $\text{GaAs}_{0.63}\text{Sb}_{0.37}$ quantum dot.