

Supporting information

Analytical study of elastic relaxation and plastic deformation in nanostructures on lattice mismatched substrates

Xu Zhang^{1,2}, Nickolay V. Sibirev¹, Vladimir G. Dubrovskii^{1, 3}, and Xiaomin Ren²*

¹St. Petersburg Academic University, Khlopina 8/3, 194021 St. Petersburg, Russia

²State Key Laboratory of Information Photonics and Optical Communications,

Beijing University of Posts and Telecommunications, P.O. Box 66,

#10 Xitucheng Road, Haidian District, Beijing 100876, China

³Ioffe Physical Technical Institute of the Russian Academy of Sciences,

Politekhnicheskaya 26, 194021 St. Petersburg, Russia

(1) III-V NWs grown by Au assisted MBE on lattice mismatched substrates

As discussed in the main text, straight III-V NWs can be obtained by Au-assisted MBE directly on Si(111) substrates, see Ref. [13] for details regarding the temperature domains and other growth conditions. Figure 1 shows the measured critical diameters in four material systems depending on their lattice mismatch, and the corresponding SEM images. InP wire marked by the arrow is bent out of shape due to dislocations.

(2) Reverse tapered shape of self-catalyzed GaAs NWs on the Si(111) substrate

As mentioned in the discussion, reverse tapering of III-V NW on Si substrates may be advantageous as it does not extend the dimension of base heterointerface which would remain dislocation-free if its initial diameter is smaller than critical. Figure 2 demonstrates such a reverse conical shape of a GaAs NW caused by the “wetting” growth mechanism described in Ref. [21].

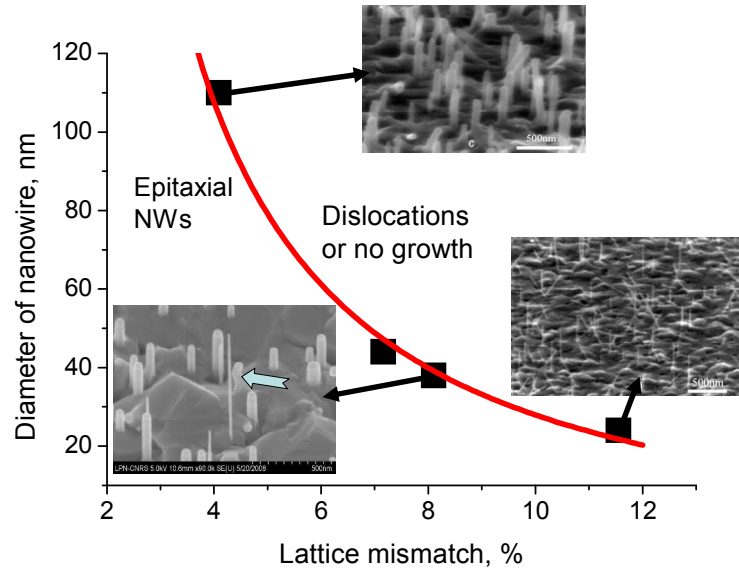


Fig. 1. Measured critical diameters of MBE grown III-V NWs on lattice mismatched substrates: 24 nm for InAs NWs on Si(111), 39 nm for InP NWs on Si(111), 44 nm for InAs NWs on GaAs(111)B, and 110 nm for GaAs NWs on Si(111) (black squares). Inserts show corresponding SEM images.

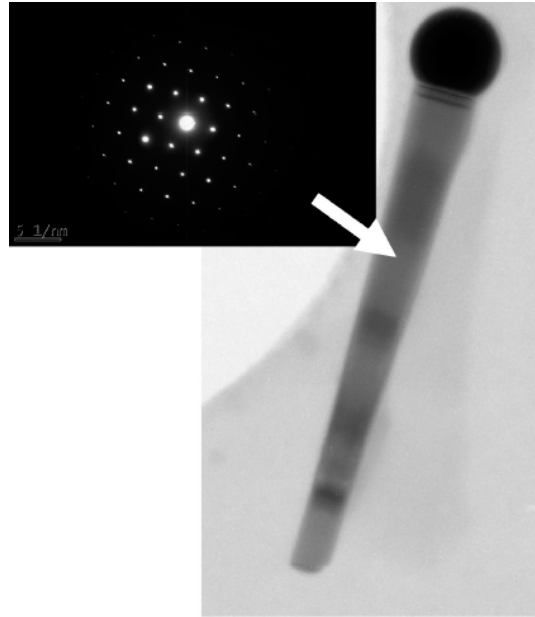


Fig. 2. TEM image of the main part of GaAs NW terminated by a Ga droplet, showing the reverse tapering. The selected area diffraction pattern, acquired from a region far removed from the droplet, shows the (110) ZB zone axis and demonstrates pure ZB structure caused by the growth mechanism (see Ref. [21] for more detail).