

## **Supporting Online Material:**

### **Epitaxial III-V Nanowires on Silicon**

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#### **Sample preparation prior to growth**

The Si (111) and Si (001) substrates were cleaned with ultrasonic Tri-clean to remove organic residues and particles as an initial cleaning step. For this cleaning step the wafer pieces were placed in test tubes with solutions and then sonicated at 35 KHz for 2-3 minutes in each solution in the following order: tri-chloro-ethylene, acetone, ethanol (95%) and deionized water.

The substrates were then removed from the rinse water and immediately cleaned with Piranha Etch to remove any remaining organic residues. The Piranha etch consisted of 7 parts Sulfuric acid (95-97 %) and 3 parts Hydrogen peroxide (30%). When mixed, an exothermic reaction causes the solution to heat to over 70°C. This mixture was poured over the samples and stirred occasionally for 6 min. The piranha etch was decanted and the samples rinsed in deionized water.

The wafers were then taken directly from the rinsing water and put in a hydrofluoric acid (HF) dip to remove the native oxide on the surface. An aqueous (5%) solution was used and the etching time was 2 min. The wafer was removed from the HF solution and care was taken that there were no visible droplets remaining on the polished side of the wafer. The samples were then transferred directly into an atmospheric controlled glove box ( $\text{H}_2\text{O}$  and  $\text{O}_2$  levels  $<1$  ppm) via a load lock for aerosol deposition. Aerosol deposition was performed using a standard method described elsewhere (referenced in the main manuscript). A standard aerosol particle diameter of 40 nm was used with particle surface densities ranging from  $\sim 0.05$  to  $40 \mu\text{m}^{-2}$ . After aerosol deposition samples were transferred to a MOVPE growth apparatus for nanowire growth.

## **Growth parameters**

**General:** The samples were then mounted on an RF-heated graphite susceptor in the growth chamber of a low pressure (10 kPa) MOVPE system. Temperature was raised to an annealing temperature of  $625^\circ\text{C}$  and the samples were annealed for 10 min under hydrogen atmosphere (6 l/min hydrogen). Temperature was then ramped down linearly during 5 min to growth temperature. Growth was initiated when the group III and group V precursors were introduced simultaneously into the growth chamber. The desired length determines the growth time but a typical time was 4 min. Growth stops when the group III-precursor is switched off. The temperature was then lowered under a protecting group V-pressure until temperature drops below  $300^\circ\text{C}$  when also the group V precursor is switched off

**GaP:** Tri-methyl-gallium (TMGa) and phosphine were used as precursors. Typical molar fraction source flows were  $1.5 \times 10^{-2}$  for phosphine and  $1.25 \times 10^{-5}$  for TMGa in a 6 l/min hydrogen carrier gas flow. Growth temperature was typically 475°C

**GaAs:** TMGa and arsine were used as precursors. Typical molar fraction source flows were  $5 \times 10^{-4}$  for arsine and  $1.25 \times 10^{-5}$  for TMGa in a 6 l/min hydrogen carrier gas flow. Growth temperature was typically 475°C

**InP:** Tri-methyl-indium (TMIn) and phosphine were used as precursors. Typical molar fraction source flows were  $1.5 \times 10^{-2}$  for phosphine and  $1.2 \times 10^{-5}$  for TMI in a 6 l/min hydrogen carrier gas flow. Growth temperature was typically 420°C