Bi-Directional Growth of Indium Phosphide Nanowires

Supporting Information

Experimental Procedures: An InP was grown using a horizontal low pressure MOVPE system. The working pressure was 0.1 atm. For InP, we used trimethylindium (TMIn) and tertiallbutylphosphine (TBP) as the source materials and InP(111)A and (111)B as the growth substrates. Partial pressures of TBP and TMIn were 1.9×10^{-4} atm and 2.7×10^{-6} atm, respectively. Growth temperature and growth time were 660 °C and 20 minutes, respectively. Diethylzinc (DEZn) was used as a p-type dopant. We changed the partial pressure of DEZn, which ranged from 0 to 6.0×10^{-6} atm.

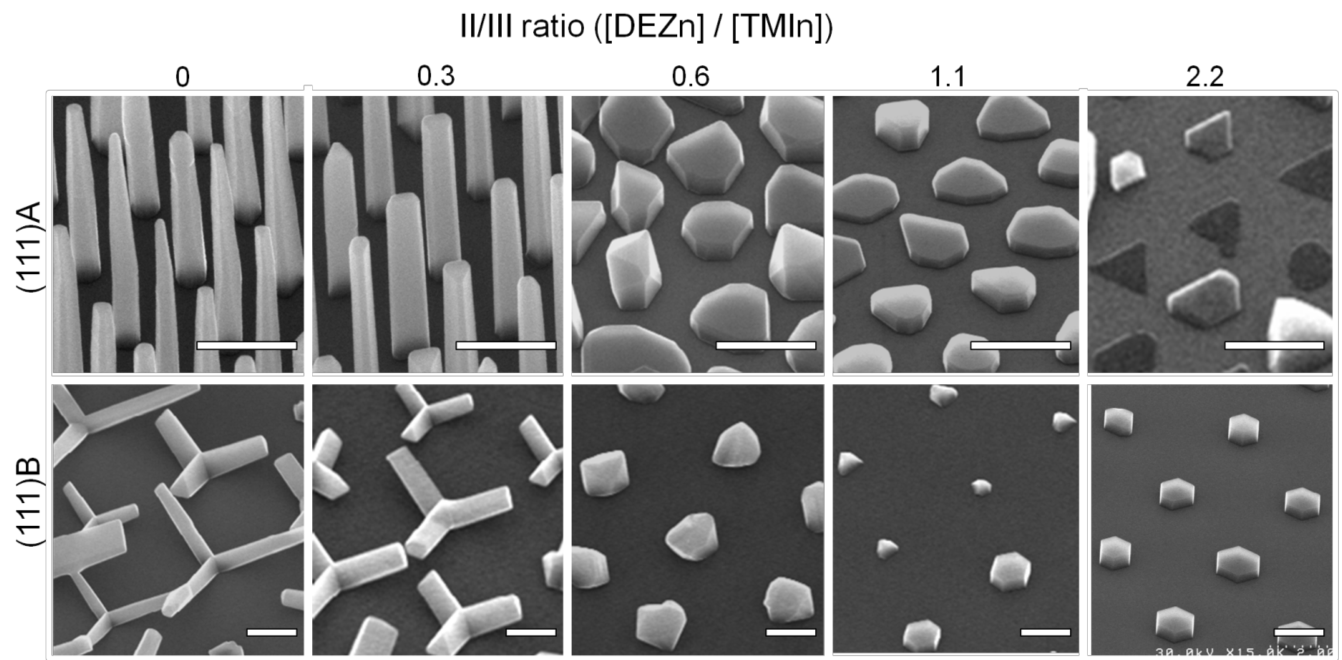

Figure S1: Results of SA-MOVPE growth of InP on (111)A and (111)B substrates. Inset scale bar: 1 μm. DEZn supply ratio (II/III ratio) changes from 0 to 2.2. On (111)A substrate, under II/III = 0, 0.3 conditions, vertical nanowires with tapered sidewalls were obtained. Tapered InP nanowires have crystal phase mixing of zincblende (ZB) and wurtzite (WZ), as we reported previously [S1]. When II/III ratio increases, vertical growth rate toward <111> A is dramatically suppressed and lateral growth is promoted because the effective V/III ratio decreases when the DEZn supply is increased. On the (111)B substrate, under II/III = 0, 0.3 conditions, we obtained tripod structures that had three nanowires toward three-fold symmetric [111]A directions. When II/III ratio increases, appearance ratio of hexagonal pillar structures, which have {-110} sidewalls, also increases.

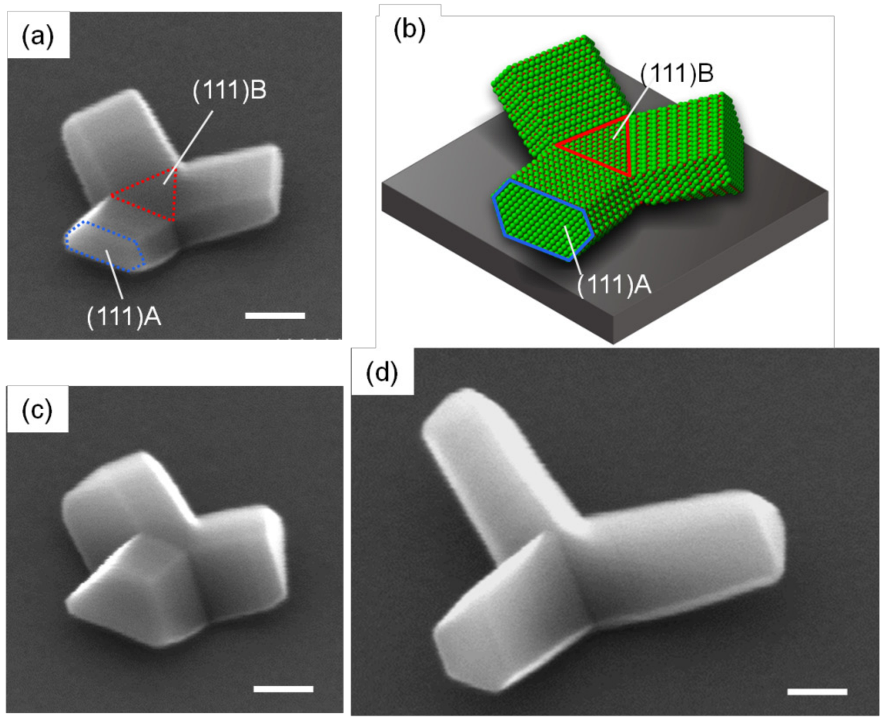

Figure S2: SEM images of early growth stage of InP on (111)B substrate under II/III = 0 condition (a), (c), (d), and their atomistic model (b). Growth time is 4 minutes. Inset scale bar: 100 nm. During truncated tetrahedral structure formation, tripod wire structures also start to grow on {111}A-inclined sidewalls when rotational twins are introduced.

[S1] Kitauchi, Y., Kobayashi, Y., Tomioka, K., Hara, S., Hiruma, K., Fukui, T., and Motohisa, J. *Nano letters*. **2010**, *10*, 1699–703.