

## SUPPLEMENTARY INFORMATION

GaAs core nanowires were grown in a low-pressure (100mbar) metalorganic vapour phase epitaxy (MOVPE) system using Au particles, following the particle assisted growth mode. The pattern of Au particles was defined using nanoimprint lithography with a wire to wire distance of 500nm and initial particle diameter of 180nm. The GaAs core was grown at 550°C using TMGa, AsH<sub>3</sub> and TESn with molar flows  $\chi_{\text{TMGa}} = 4,3 \times 10^{-5}$ ,  $\chi_{\text{AsH}_3} = 7,7 \times 10^{-5}$  and  $\chi_{\text{TESn}} = 4,3 \times 10^{-7}$ . The samples on which the core nanowires had been grown were removed from the growth chamber and the Au seed particles were etched down using a KCN-based Au etch to control axial growth during the subsequent shell growth. The GaAs core nanowires were reinserted into the MOVPE system and after an annealing step at 650°C in AsH<sub>3</sub>/H<sub>2</sub> atmosphere, a GaInP shell was grown for 5min at 600°C by simultaneously switching AsH<sub>3</sub> to PH<sub>3</sub> and introducing TMGa and TMin. The molar fractions for the shell growth was  $\chi_{\text{PH}_3} = 1,5 \times 10^{-2}$ ,  $\chi_{\text{TMGa}} = 12 \times 10^{-6}$  and  $\chi_{\text{TMin}} = 8,2 \times 10^{-6}$ .