Supplementary information

Electrical properties of GaSb/InAsSb core/shell nanowires

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Figure 1: SEM images (52° tilt) of GaSb-InAs core-shell nanowires after selective etching of the InAs shell using citric acid:hydrogen peroxide (2:1) solution for 12 seconds.
Figure 2:(a) the intrinsic conductance versus gate voltage for GaSb/InAs core/shell NW device with an intermediate InAs shell thickness of 5-7 nm. The nanowire shows ambipolar semiconducting behavior, with $\rho_i = 24 \, \text{m}\Omega\text{cm}$ at $V_{GS} = 0 \, \text{V}$ and contact resistance of $R_C = 1 \, \text{k}\Omega$. For negative gate voltages the GaSb core is populated with holes, and the shell is depleted from charge carriers, giving a $p$-type back-gate response. For sufficiently positive gate voltages the InAs shell is populated with electrons, which leads to an onset of $n$-type back-gate behavior. (b) The field effect mobility of the nanowire as a function of gate voltage. (c) The Carrier concentration versus gate voltage.
Figure 3: Room temperature field effect mobility of a few different GaSb/InAs core/shell and GaSb NWFETs vs gate voltage.
Figure 4: (a) The contact resistance vs. $V_{GS}$ at different temperatures for GaSb/InAs core/shell NWs. (b) Extracted activation energies from the temperature dependence of the contact resistance. (c) The total device resistance ($R_{2P}$) vs. $V_{GS}$ at different temperatures for GaSb/InAs core/shell NWs. (d) Extracted activation energies from the temperature dependence of the total device resistance ($R_{2P}$).
Figure 5: AC performance of a GaSb/InAs core/shell nanowire based frequency multiplier. Input and output waveform for (a) an input 10 kHz and (b) an input 20 kHz.