Supporting information

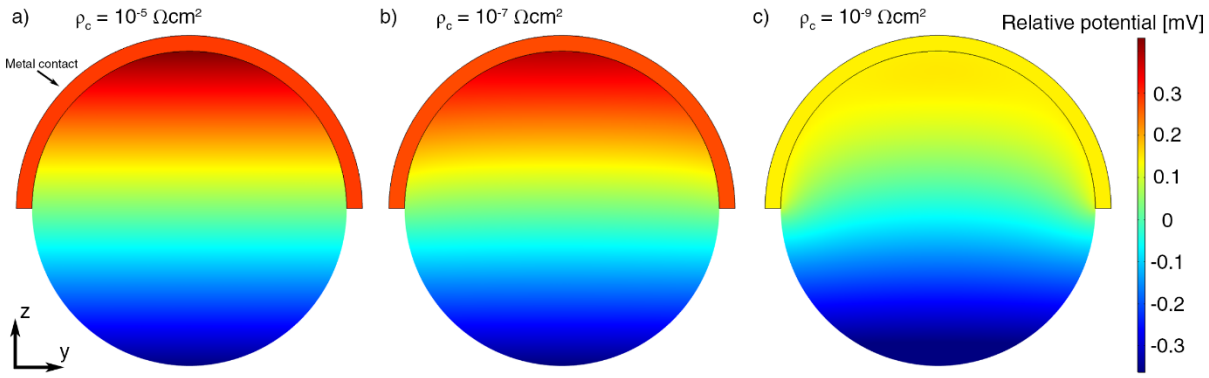

Figure S1. Potential in center cross-section of a three-probe Hall NW device with $\alpha = 180$ *deg.* $n = 10^{18}$ cm^{-3}, $w_c = 50$ *nm,* $r = 100$ *nm. The magnetic field is parallel to y and the current is perpendicular to the plane of the figure. a)* $\rho_c = 10^{-5}$ Ωcm^2, *b)* $\rho_c = 10^{-7}$ Ωcm^2, *c)* $\rho_c = 10^{-9}$ Ωcm^2.

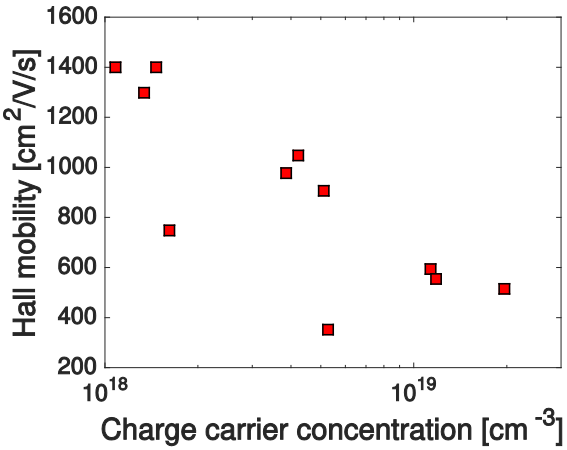

Figure S2. Hall mobility as function of charge carrier concentration measured with the three-probe Hall method.

Growth details, thin Sn-doped InP nanowires

The growth substrate was prepared from a piece of a InP:Zn (111)B wafer, on which 50 nm diameter gold particles at a density of 0.8 μm^{-2} were deposited by an aerosol method (ref S1). The growth substrate was inserted into a metal-organic vapor phase epitaxy system (Aixtron 200/4), using a working pressure of 100 mbar, a total gas flow of 13 L/min and H_2 as a carrier gas. The sample was heated to 550 °C under a PH_3/H_2 gas flow for a 10 minute annealing step to desorb surface oxides. Thereafter, the sample was cooled to the growth temperature of 420 °C where growth was initiated. Growth precursors used were TMIn and PH_3, at constant molar fractions of $\chi_{TMIn} = 2.0 \times 10^{-5}$ and $\chi_{PH3} = 6.9 \times 10^{-3}$. After 15 seconds, HCl was added to the precursor flow to impede radial growth (ref S2), at a molar fraction of $\chi_{HCl} = 4.6 \times 10^{-5}$. As a dopant precursor, TESn was turned on throughout the growth. For the first and last 2.5 minutes of growth, highly doped end-segments were grown to ensure good contacts, with a molar fraction of $\chi_{TESn} = 1.3 \times 10^{-5}$. For the middle segment, which was probed by the three-probe Hall measurement shown in fig. 6, a molar fraction of $\chi_{TESn} = 5.5 \times 10^{-6}$ was used. Total growth time was 19 minutes, after which TMIn and TESn was switched off, and the sample was cooled in a PH_3/H_2 atmosphere.
The as grown nanowires were about 4.2 µm in length, and had a diameter of about 65 nm (Figure S3).

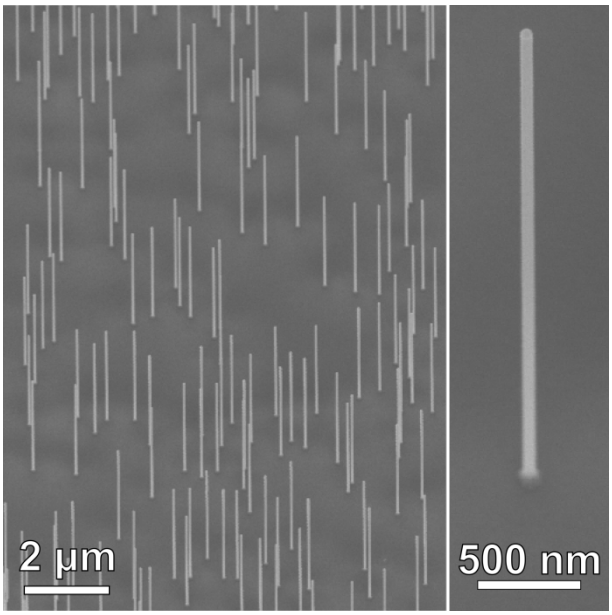

Figure S3. Scanning electron microscopy images of as-grown Sn-doped InP nanowires, taken at 30° tilt.

Ref S1: DOI: 10.1016/S0965-9773(99)00063-X
Ref S2: DOI: 10.1007/s12274-010-1029-x