Supplementary information for

Multiple morphologies and functionality of nanowires made from earth-abundant zinc phosphide

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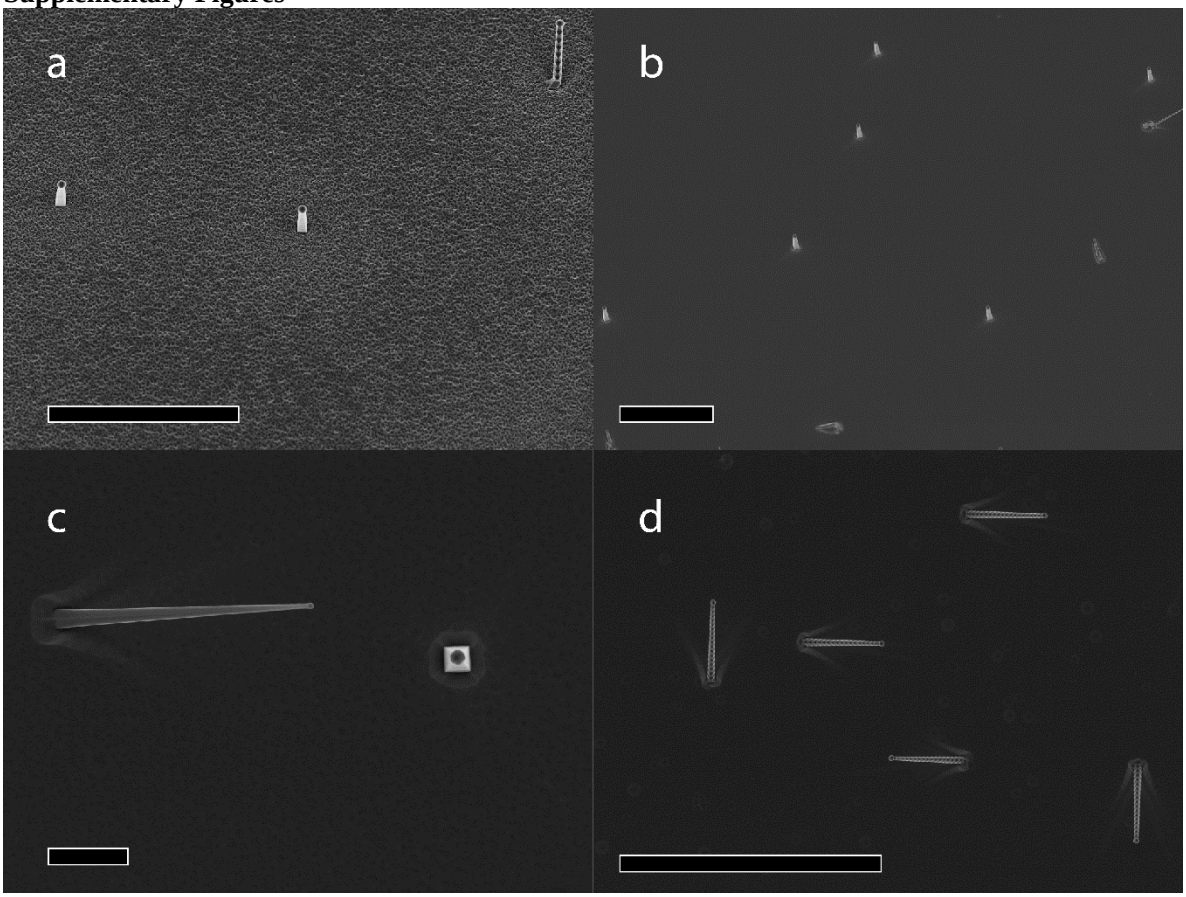
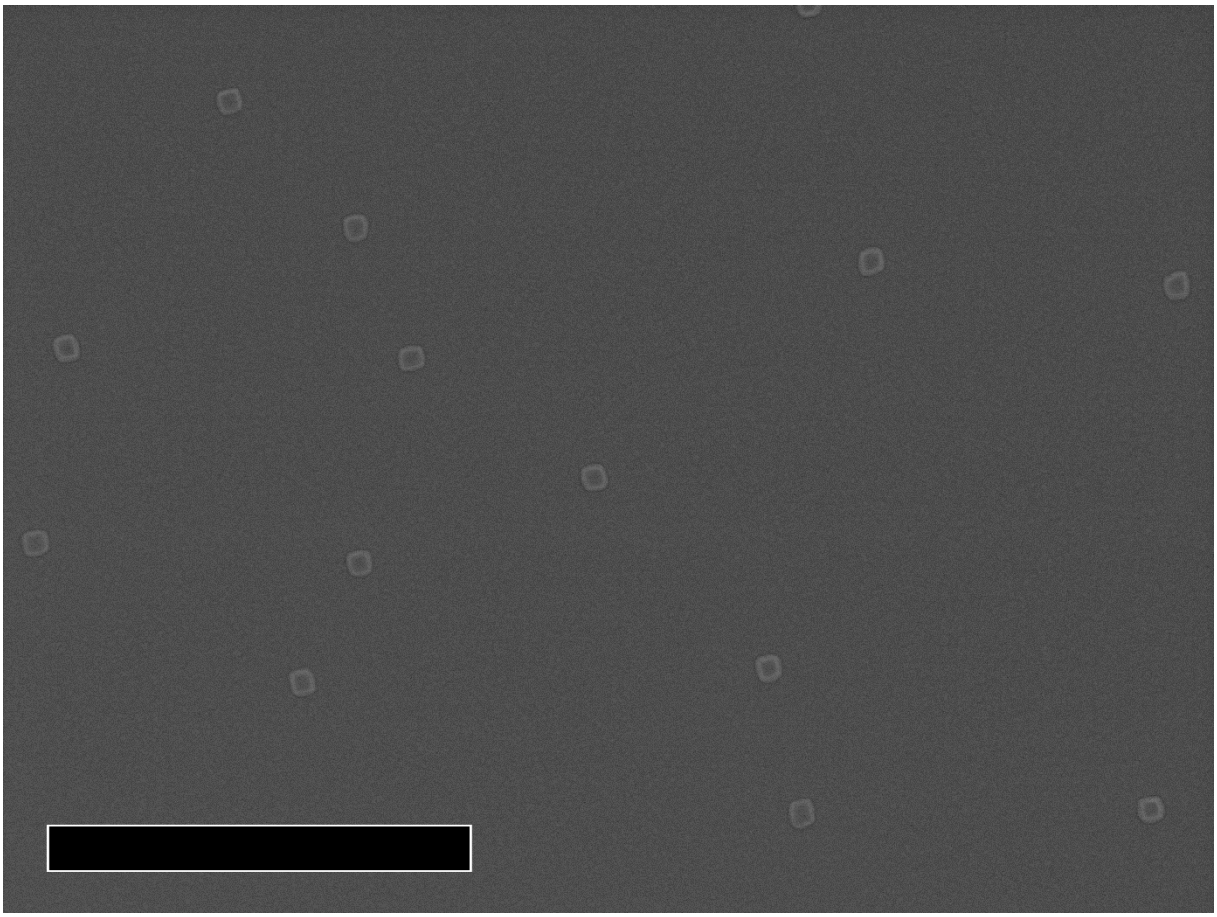
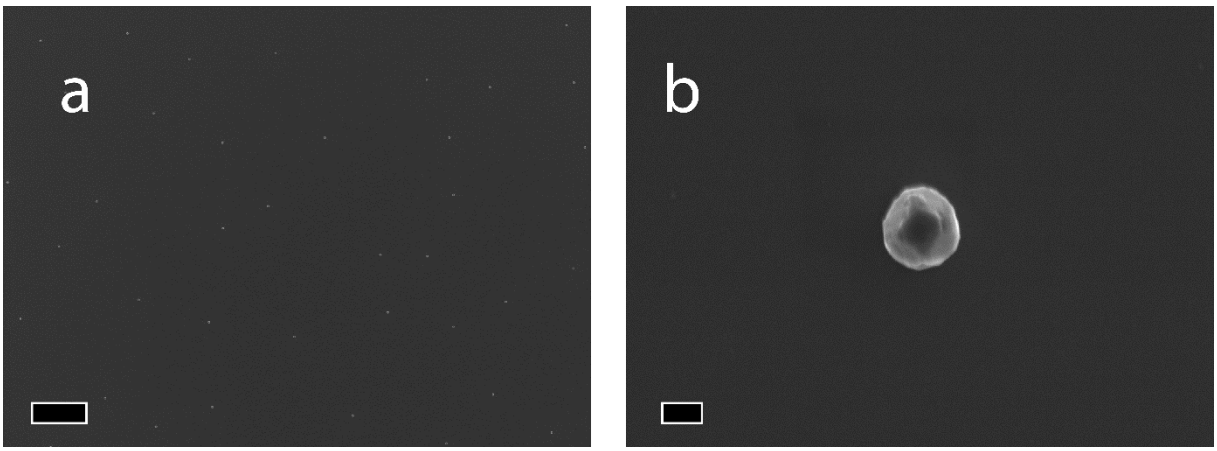
Supplementary Figures



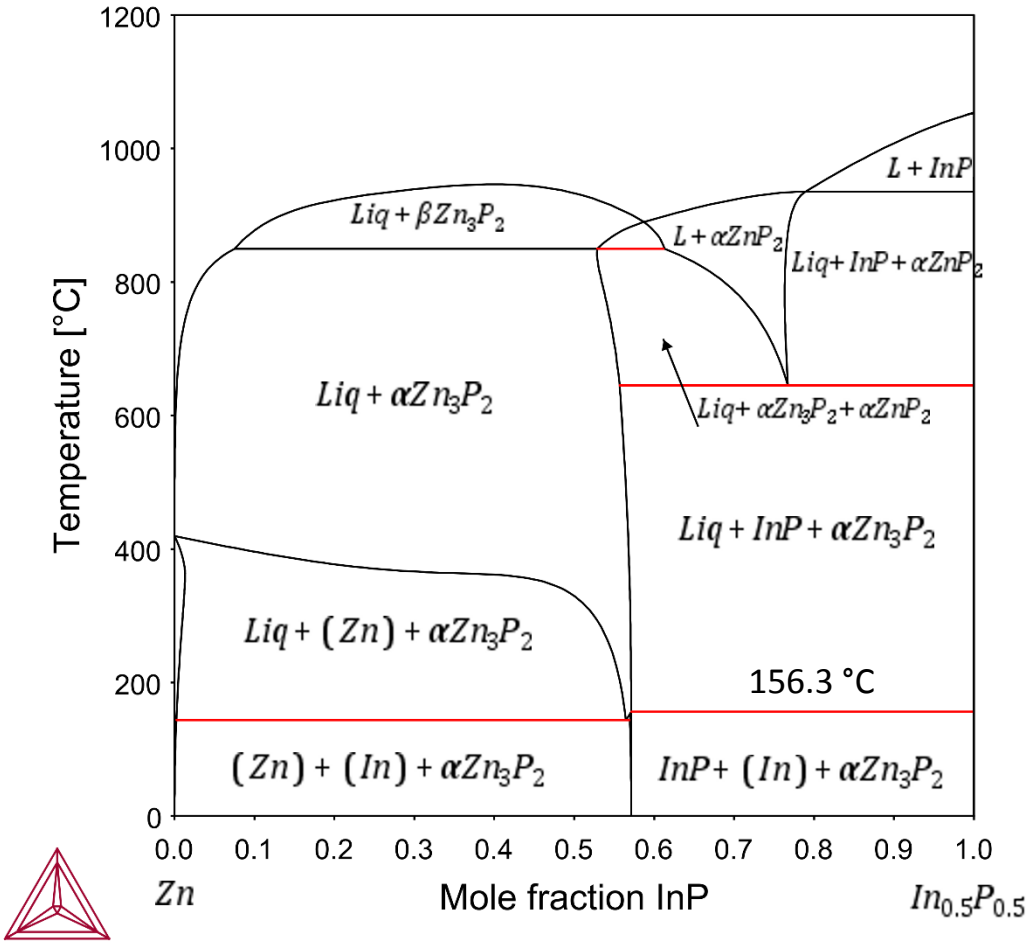
Supplementary Figure S1. SEM of nanowires at different magnifications. (a) and (b) are of vertical nanowires observed at 20° tilt (V/II ratio = 1.15 and 1.30, respectively). (c) shows a straight-tilted and vertical nanowire in close proximity (V/II ratio = 1.00) (d) is a top view image of zigzag nanowires (V/II ratio = 1.45). a, b and d have 10 μm scalebars, c has a 1 μm scale bar.



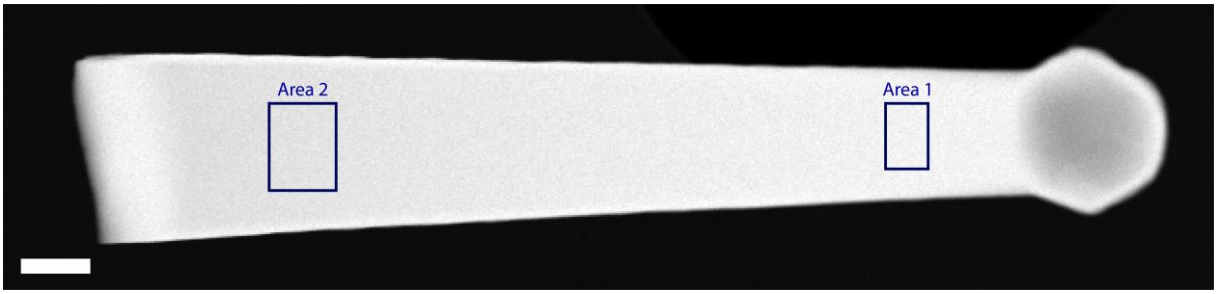
Supplementary Figure S2. SEM of thin film overgrowing the catalyst particles. 10 μm scalebar.



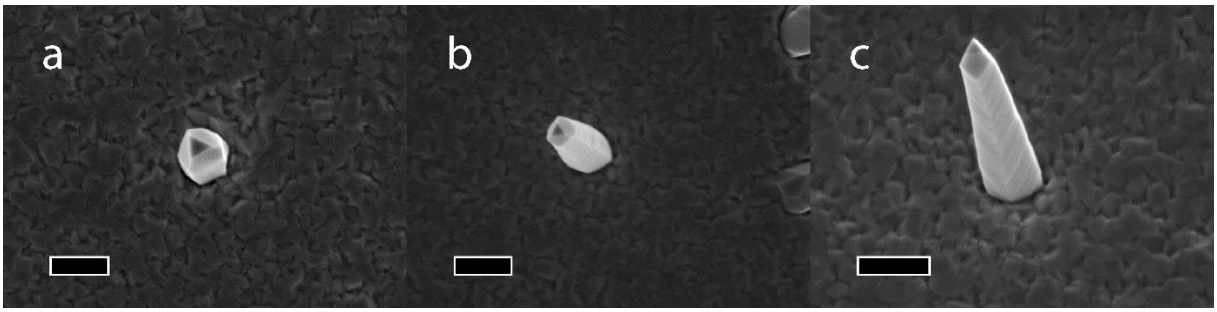
Supplementary Figure S3. SEM images of the initial catalyst particles at room temperature at different magnifications. The particles were generated using a 5 minutes zinc predeposition at 200 °C at a flux of 3.4×10^{-7} Torr. The average size was 365 nm with a standard deviation of 8 nm, and a density of one particle per 323 μm^2. Scale bars are 10 μm and 200 nm respectively.



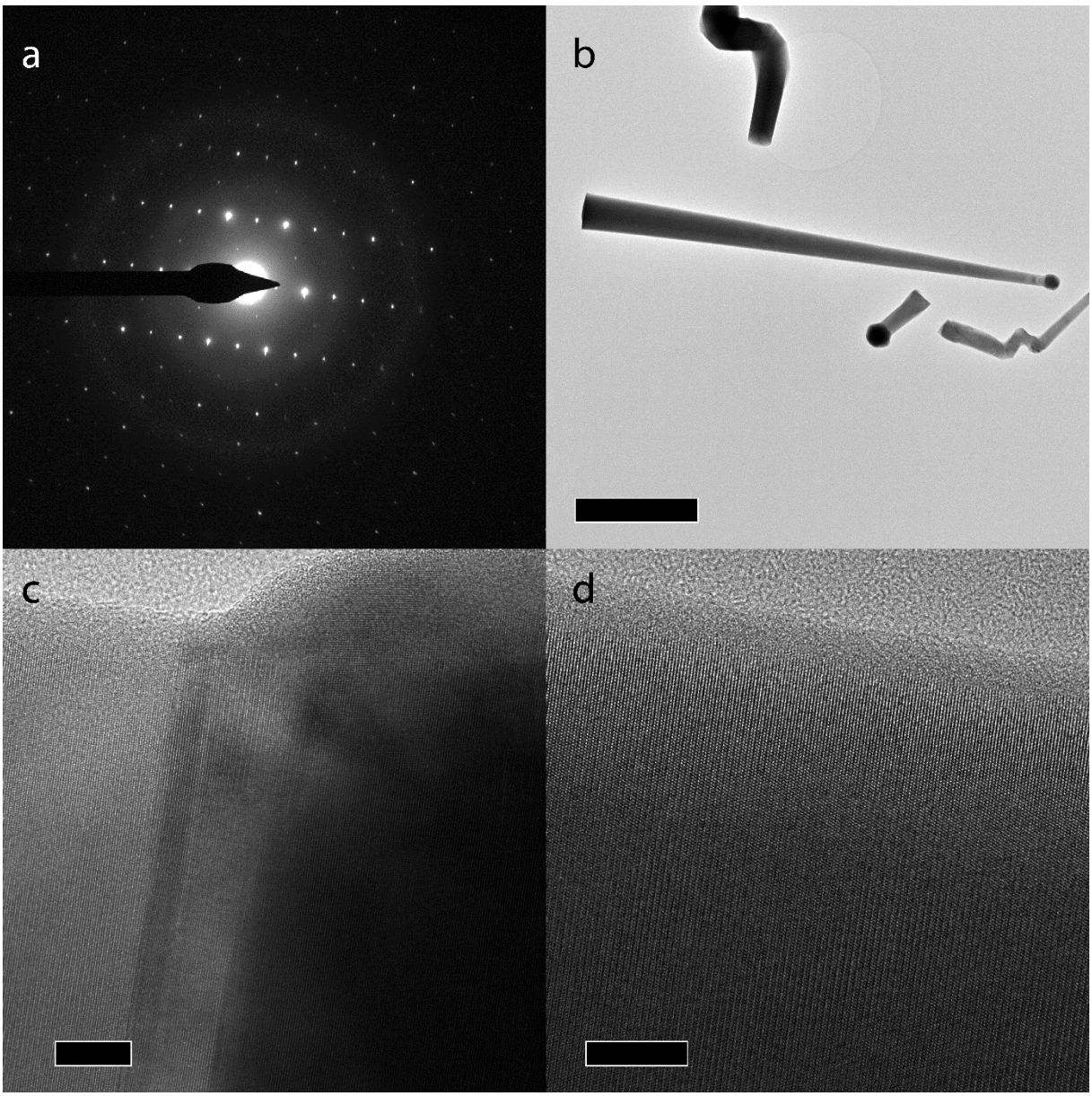
Supplementary Figure S4. Vertical section between Zn and InP, showing the transition at 156.3 °C from the liquid phase to the room temperature phases.



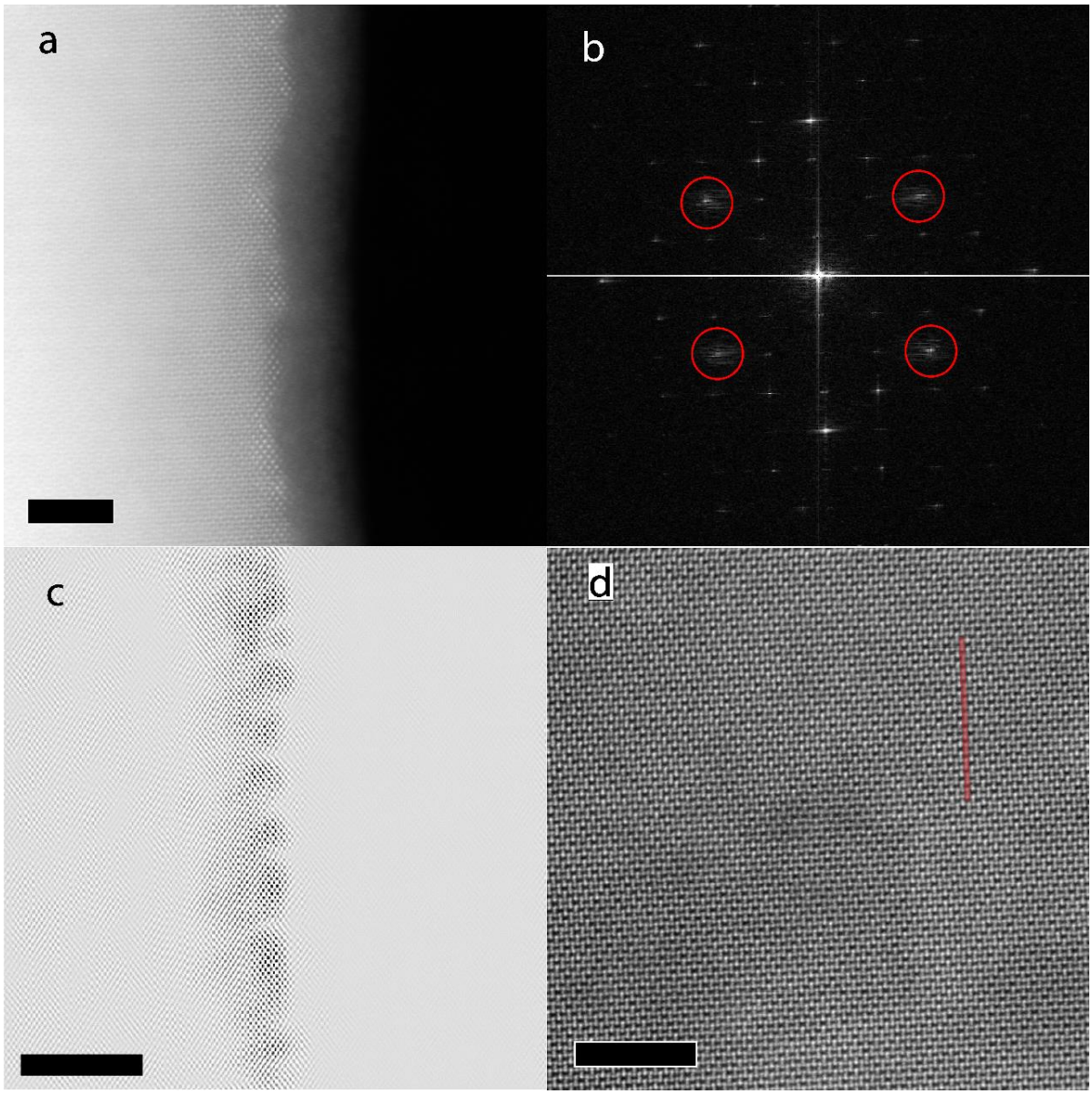
Supplementary Figure S5. HAADF-STEM image of a vertical nanowire grown at a V/II ratio of 1.45 used for full wire EDX analysis. The composition of Area 1 (top) is 60.34% Zn and 39.66% P. The composition of Area 2 (bottom) is 60.71% Zn and 39.29% P. The scale bar is 250 nm.



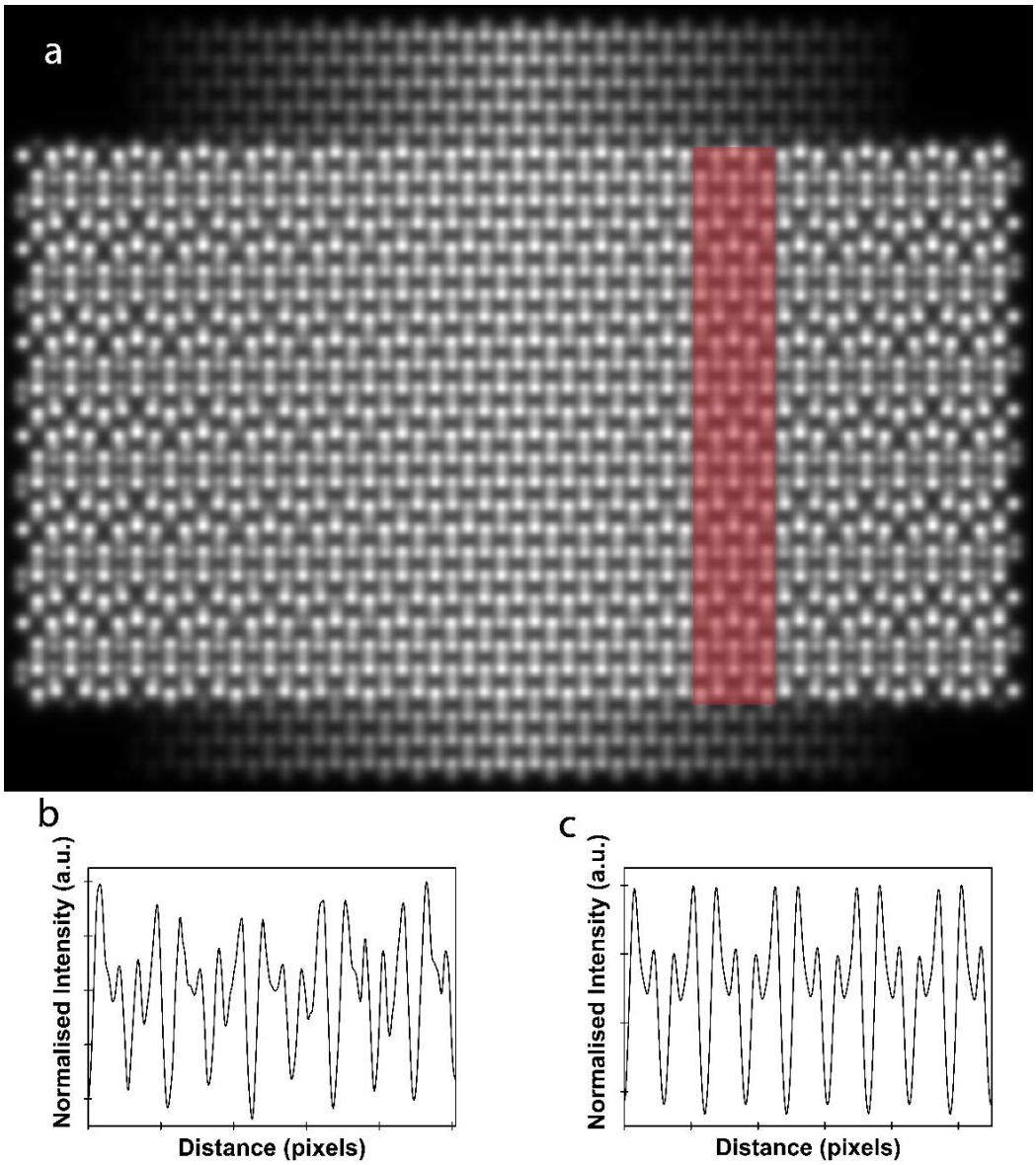
Supplementary Figure S6. SEM of VS grown Zn3P2 nanowires. (a) and (b) are top view images, whilst (c) is acquired at 20° tilt. Scale bars are 500 nm.



Supplementary Figure S7. (a) shows the SAED pattern along the [1 1 1] zone axis. (b) is a low magnification image of the whole nanowire. (c) and (d) are HRTEM images of the nanowire in regions close to the droplet and towards the centre of the nanowire, respectively. Note that no stacking faults are observed along this zone axis. Scale bar in b is 1 μm, scale bars in c and d are 10 nm.



Supplementary Figure S8. (a) is a low magnification AC-HAADF STEM image of the surface of a vertical nanowire. (b) shows the FFT, and the red circles show the areas where we applied a mask to do an inverse FFT (c). (c) highlights the areas with a different crystal structure based on the applied mask. (d) shows a low magnification AC-HAADF STEM image of the bulk of the nanowire. The red line indicates where the line profile, presented below, was taken to compare with models to match the pattern and composition. Scale bar in c is 10 nm, in a and d they are 5 nm.



Supplementary Figure S9. (a) Simulated STEM image of the zinc rich Zn_3P_2 along the [1 0 0] zone axis. The edges shows the expected pattern for stoichiometric Zn_3P_2 whilst the centre shows Zn_2P, where all vacant sites are filled with Zn atoms, assuming no change in crystal symmetry. The pattern observed in Figure 4l and Supplementary Figure S5d corresponds to a very Zn rich material, close to the highlighted region, as supported by the line intensity profiles of the measured (b) and modelled (c) intensities.