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SUPPLEMENTARY INFORMATION

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Single crystalline kinked semiconductor nanowire superstructures

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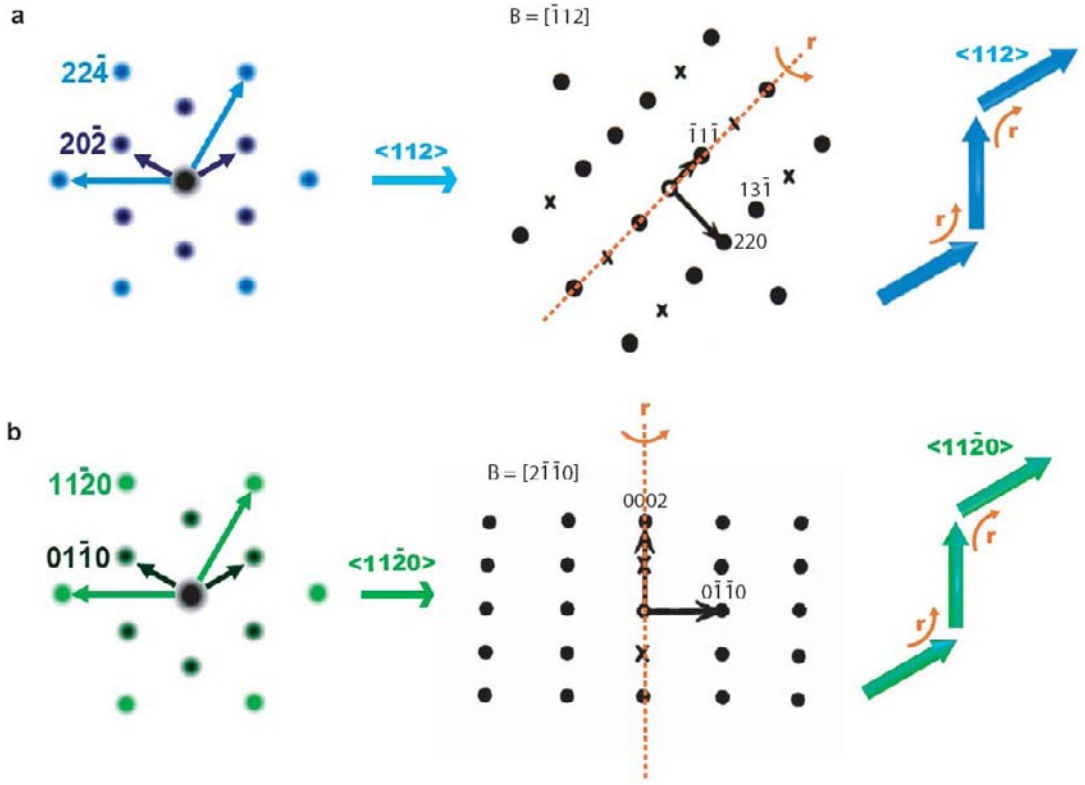

Figure S1 | Crystallographic design of kinked semiconductor nanowire superstructures. a, Key crystallographic parameters for rational synthesis of kinked semiconductor nanowires with cubic crystal structures. The group *IV* atoms (*e.g.*, silicon and germanium) arrange in the "*diamond structure*", while Group *III(II)* and Group *V(VI)* atoms adopt the "*zinc-blende*" or "*sphalerite*" structural motifs. The left panel depicts a schematic electron diffraction (ED) pattern[1] from a cubic single crystal recorded along the [111] zone axis. Light and dark blue arrows mark a pair of <112> and <110> directions, respectively, with an angle of 120° separating identical directions in the (111) plane. We focus our discussion on nanowires with <112> orientations and those defined by the diamond crystal structure (*e.g.,* silicon and germanium). The schematic [-112] zone ED pattern[1] (middle panel), which corresponds to an ED pattern recorded from the cross section of a <112>-oriented silicon nanowire, identifies a single <111> axis. Inducing rotation about this <111> axis at controlled points in a nanowire would yield a 2D multi-kinked superstructures (right panel). We also note that kink-arm growth will be coherent, that is with preservation of the original <112> orientation of the silicon nanowire. **b**, Key crystallographic parameters for rational synthesis of kinked semiconductor nanowires with

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hexagonal crystal structures, for example, the "*wurtzite*" structures of the *II-VI* and *III-V* semiconductors cadmium sulphide and gallium nitride. A schematic ED pattern recorded along the [0001] zone axis[1] (left panel) shows pairs of <11-20> or <1-100> directions with 120° between identical directions in the (0001) plane. Similar to the discussion in **a**, there is a single <0001> axis in <11-20>-oriented nanowires as visualized in the schematic [2-1-10] zone ED pattern[1] (middle panel). A 2D multi-kinked superstructures of <11-20>-oriented *wurtzite* nanowires (right panel) is formed by rotating about this <0001> axis. In ED patterns, the zone axis is denoted as **B**, and **×** symbols mark double diffraction spots[1].

Reference:

1. Wang, Z. L. & Kang, Z. C. *Functional and Smart Materials Structural Evolution and Structure Analysis (1st edition)* (Plenum Press; New York, 1998).

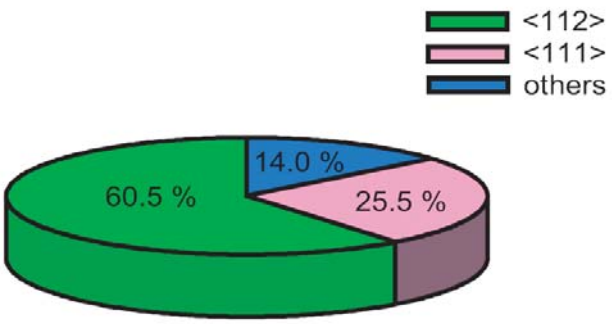

Figure S2 | Growth orientation statistics for silicon nanowires with. The silicon nanowires were grown using 80 nm diameter gold nanocluster catalysts at 455 – 460 °C and 40 torr total pressure. The flow rates of silane, phosphine and hydrogen were 1 – 2, 2 – 10 and 60 standard cubic centimetres per minute, respectively. Transmission electron microscopy (TEM) imaging and electron diffractions (ED) were used to identify the nanowire orientations. Under these growth conditions, <112>-oriented nanowires predominate.

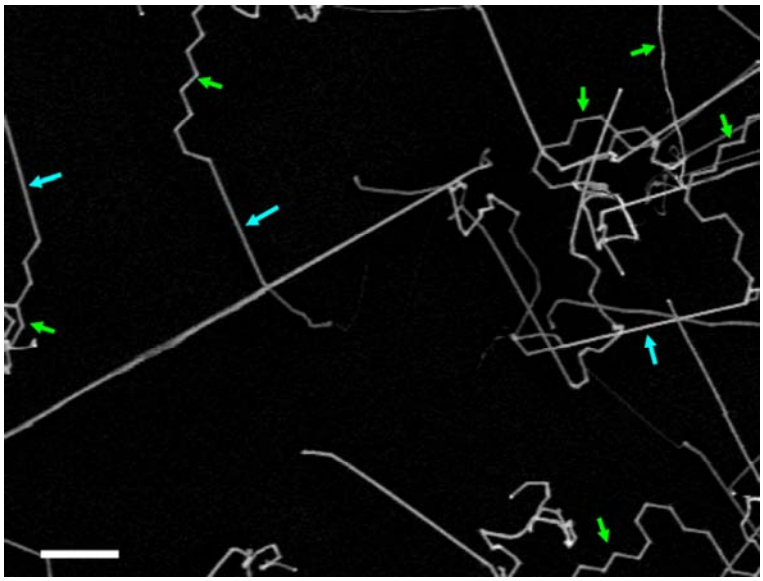

Figure S3 | SEM image of multiply kinked nanowires on the growth substrate. Nanowire synthesis started with an initial ca. 8-12 μm straight segments (marked with cyan arrows) followed by sequential modulation to introduce multiple kinks with a segment length of 0.8 μm (marked with green arrows). The yield of kinked nanowires is ca. 45%. The ca. 80 nm diameter nanowires do not exhibit a particular orientation on the Si/SiO_2 growth substrate. White scale bar is 2 μm.