

Supplementary Material for

Crystal orientation-ordered ZnS nanobelt quasi-arrays and their enhanced field-emission

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Experimental Section

The syntheses of aligned and randomly-oriented ZnS nanobelts were conducted in a conventional horizontal tube furnace with a 36 mm inner-diameter quartz tube. The seeding ZnS sheets, which were prepared by pressing ZnS nanoparticles (mesh ~ 100 nm) under 40 MPa, were placed on a long alumina plate to act as the deposition substrates for the synthesis of ZnS nanobelt quasi-arrays; whereas a long alumina plate was used as the deposition substrate for the growth of randomly oriented ZnS nanobelts, while the other experimental parameters were kept unchanged. Commercial ZnS powders (~ 10 μm) were used as a precursor which was put into an alumina boat, and the boat was then covered with a quartz sheet to maintain a high vapor pressure. The boat was placed in the center of the tube furnace, and the substrate was mounted on it. The tube furnace was purged with high-purity argon (Ar) for 3 h prior to heating. The furnace was heated to 1100°C in 10 min and kept at this temperature for 60 min. High-purity Ar served as a protecting medium and carrying gas. During the process, the Ar flow rate was kept at 100 sccm.

After the furnace was cooled to room temperature, white wool-like products were found on the substrates. The collected products were characterized by a field-emission scanning electron microscope (SEM, JSM-6700F), a powder X-ray diffractometer (XRD, RINT 2200HF), and a transmission electron microscope (HRTEM, JEM-3000F) equipped with an X-ray energy dispersive spectrometer (EDS). The present FE measurements were conducted in a vacuum chamber at a pressure of 4.6×10^{-6} Pa at room temperature. A rod-like aluminum probe with a 1 mm² cross-section area was used as an anode, and quasi-aligned ZnS nanobelt arrays or randomly oriented ZnS (for comparison) nanobelt films served as cathodes. The shape of random ZnS nanobelts (for comparison) was very close to quasi-aligned and oriented ZnS nanobelts. A dc voltage sweeping from 100 to 1100 V was applied to a sample at a step of 5 V.^{Ref1} The spacing between the anode and the cathode was set at 200 μm .

The reference describing the field-emission measurements: Y. B. Li, Y. Bando, D. Golberg and K. Kurashima, *Appl. Phys. Lett.*, 2002, **81**, 5048.

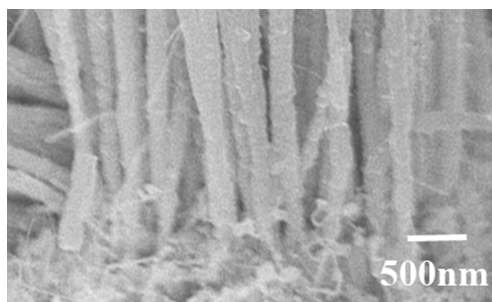


Figure S1. SEM image of the nanobelt bottom ends. The nanobelts were synthesized on a ZnS pre-seeded deposition substrate. The experimental conditions were same as those in Figures 1e and 1f.