Synthesis and Electric Properties of Dicobalt Silicide Nanobelts

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1. Experimental

Synthesis of Dicobalt Silicide Nanobelts: Silicon (100) pieces with native silicon oxide layers were used as the growth substrate. The Si pieces were washed with Piranha [1:4 H_2O_2 (30%): H_2SO_4 (concentrated)], rinsed with deionized water, acetone and isopropanol, and dried with N_2 gas blow. The cleaned growth substrates were then placed at the center of a single-zone horizontal tube furnace and ca. 50 mg anhydrous $CoCl_2$ in a quartz boat was placed upstream of the growth substrate. Initially, the system was evacuated to less than 30 mTorr. Ar (99.997%) gas at a flow rate of 200 sccm was fed through the quartz tube as the carrier gas, and the total pressure was maintained at ~ 1 psi above the ambient pressure. Temperature of the growth substrate was fixed at 750 °C and temperature of $CoCl_2$ precursor controlled between 600 °C and 630 °C.

Device Fabrication and Low Temperature Measurements: The Co_2Si nanobelts were transferred from the growth substrate onto a Si substrate with a 300 nm silicon oxide layer via contact printing dry transfer process. The contact electrodes were defined using e-beam lithography followed by Ti/Au (50nm/50nm) metallization. The low-temperature measurement was carried out with Oxford cryogenic system.

Characterization: The as-grown samples were inspected by scanning electron microscope (SEM) (JEOL 6700) with an electron acceleration voltage of 10 keV. Transmission electron microscope (TEM) imaging was conducted on a Phillips CM120 with a 120 kV operation voltage. The HRTEM, SAED and EDX spectroscopy were collected on FEI TITAN with a 300 kV operation voltage.

2. SEM and TEM images of the nanostructures obtained at various temperatures of $CoCl_2$ precursor.

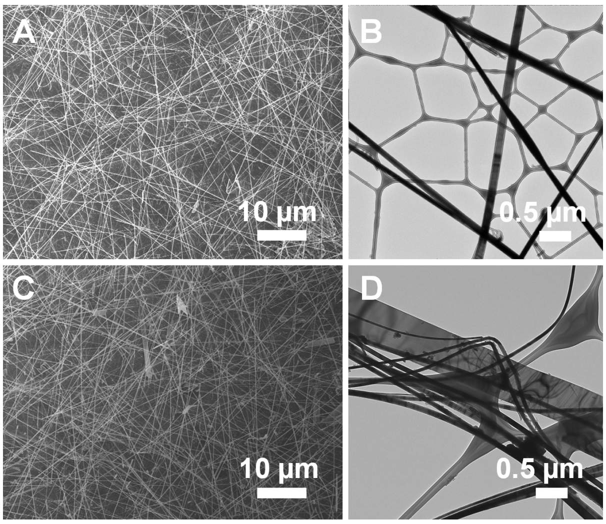

Fig. S1. SEM and TEM images of the nanostructures obtained at various temperatures of $CoCl_2$ precursor: (A), (B) 600 °C; (C), (D) 615 °C.

3. AFM image of the Co_2Si nanobelt used in electrical and MR measurements.

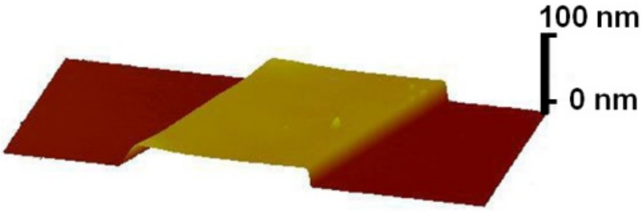

Fig. S2. AFM image of the Co_2Si nanobelt used in electrical and MR measurements shows an overall thickness of 25 nm (including surface oxide layers). The image area is 2 µm × 1 µm.

4. TEM image showing the oxide layer on a Co2Si nanobelt.

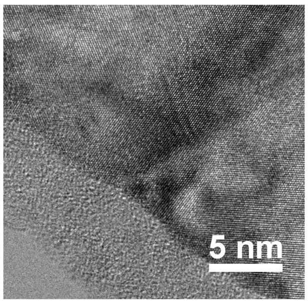

Fig. S3: TEM image of Co_2Si nanobelt with 7 nm silicon oxide shell.

5. Magnetoresistance curve of the Co_2Si nanobelt in the range of ± 5 T at 1.5 K.

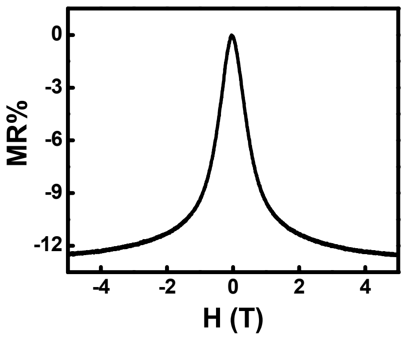

Fig. S4. Magnetoresistance curve of the Co_2Si nanobelt in the range of ± 5 T at 1.5 K.