Electronic Supplementary Information

Hydrothermal synthesis and magnetic properties of single-crystalline $BiFeO_3$ nanowires

Bing Liu, Binbin Hu, and Zuliang Du*

Key Laboratory for Special Functional Materials of the Ministry of Education, Henan University, Kaifeng 475004 , China

E-mail: zld@henu.edu.cn

I. Materials and Methods

Materials

$Bi(NO_3)_3 \cdot 5H_2O$, $FeCl_3 \cdot 6H_2O$, acetone, ammonia, sodium hydroxide and alcohol were obtained from Tianjin Kermel Chemical Reagent Co., Ltd. All chemicals were analytical reagent and used as received without any further purification.

Synthesis

In a typical experiment, the starting materials, [$Bi(NO_3)_3 \cdot 5H_2O$] and [$FeCl_3 \cdot 6H_2O$] in a stoichiometric ratio (1:1 in molar ratios), were dissolved in acetone(50mL) with stirring and ultrasound until completely dissolved. Secondly, distilled water(200mL) was added and stirred. Then thick ammonia was added until the pH value of the mixed solution reached 10-11. The sediment was centrifuged out and washed with distilled water several times until the pH value was neutral. Thirdly, 5 M NaOH was added with stirring for 30 minutes. Then the solution was transferred to a sealed, Teflon-lined steel autoclave and

heated at 180 °C for 72 hours. The black powder obtained after filtration was washed with distilled water and alcohol and dried at 60 °C for characterization.

In a contrast experiment, the starting materials, [$Bi(NO_3)_3 \cdot 5H_2O$] and [$FeCl_3 \cdot 6H_2O$] in a stoichiometric ratio (1:1 in molar ratios), were processed all the same as above procedure. In the third steps, the solution was transferred to a sealed, Teflon-lined steel autoclave and heated at 180 °C for 72 hours without any NaOH. As-prepared sample terms contrast S1.

II. Characterization

TEM and HRTEM images and SAED patterns were recorded digitally with a SIS charge-coupled device (CCD) camera and iTEM analysis software on a JEOL 2010 electron microscope operating at 200 kV. Variable-temperature magnetization measurements under the magnetic field of 100 Oe (1 Oe = 79.577 A m^{-1}),2000Oe and under both zero-field-cooled (ZFC) and field-cooled (FC) conditions were performed on a Quantum Design SQUID MPMS XL-7 (SQUID) at temperatures ranging from 350 K down to 1.9 K. The dc hysteresis loops were collected on the same SQUID in magnetic fields of -6000 Oe to 6000 Oe at 5 K and 300 K, respectively.

1. HRTEM image of the $BiFeO_3$ nanowire.

2. Structure analysis through comparison between the simulated ED pattern and the measured SAED pattern of the $BiFeO_3$ nanowire.

3. Zero-field-cooled (ZFC) and field-cooled (FC) susceptibility measured in a field of 2000 Oe for $BiFeO_3$ nanowires.

4. TEM image of the precursors of short nanorods (contrast S1).

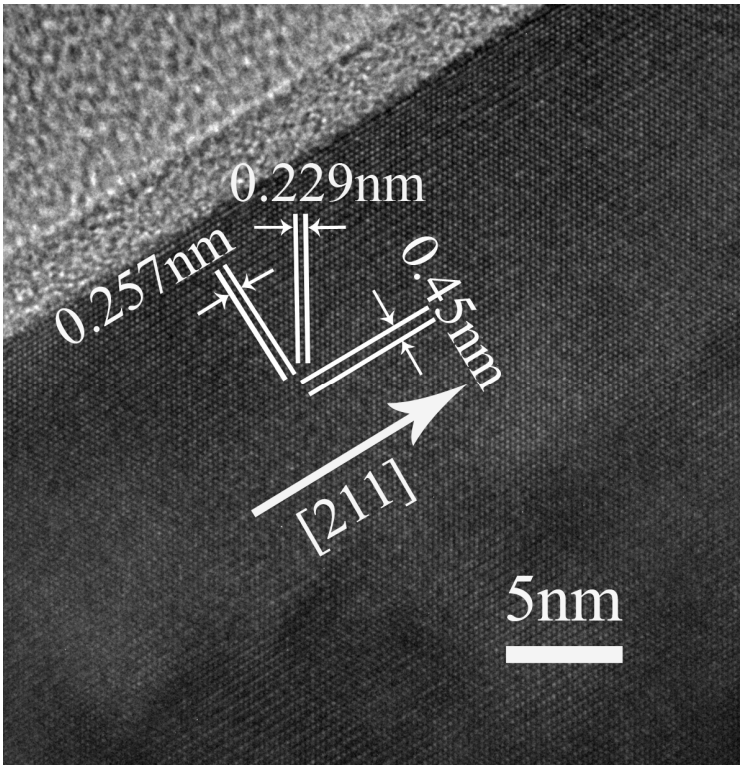

Figure S1. HRTEM image of a typical portion of a corresponding $BiFeO_3$ nanowire.

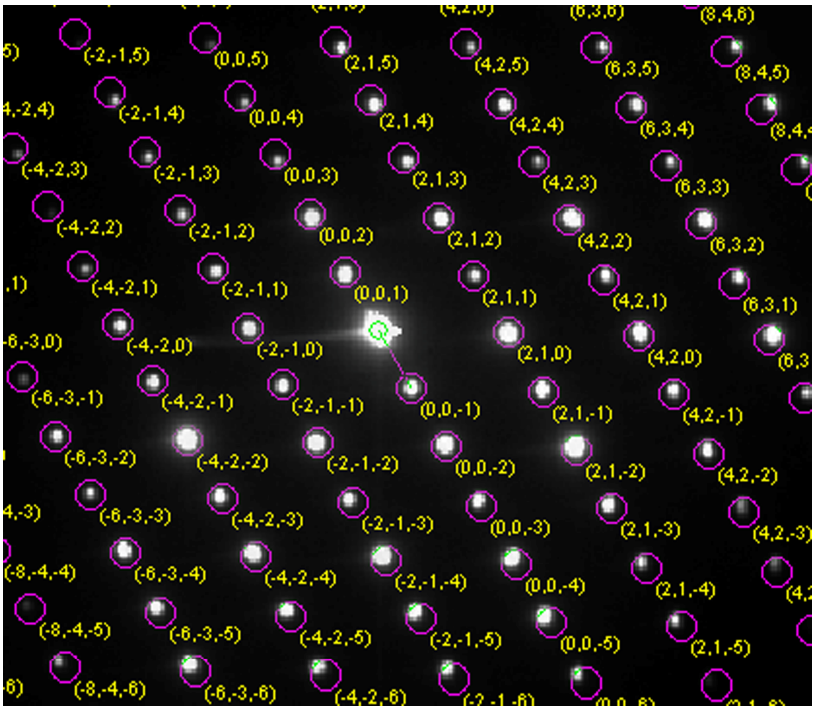

Figure S2. Overlap of the simulated ED pattern (○) and measured SAED pattern (●) of the $BiFeO_3$ nanowire.

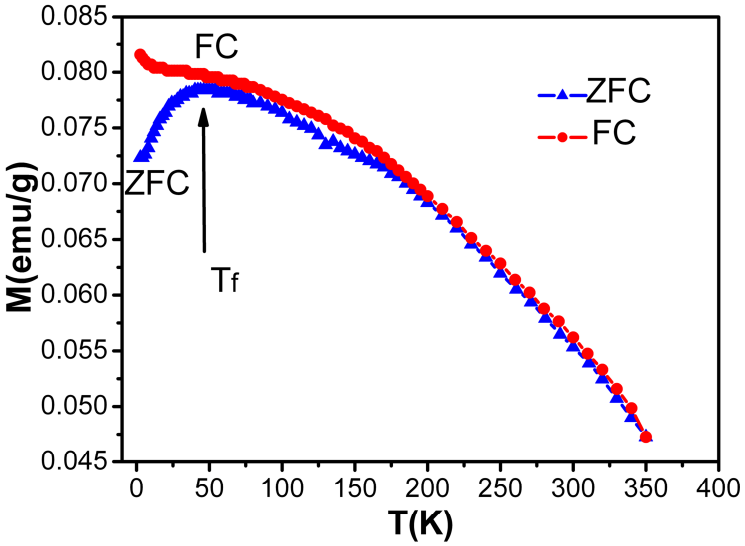

Figure S3. Temperature dependence of zero-field-cooled (ZFC) and field-cooled (FC) susceptibility measured in a field of 2000 Oe.

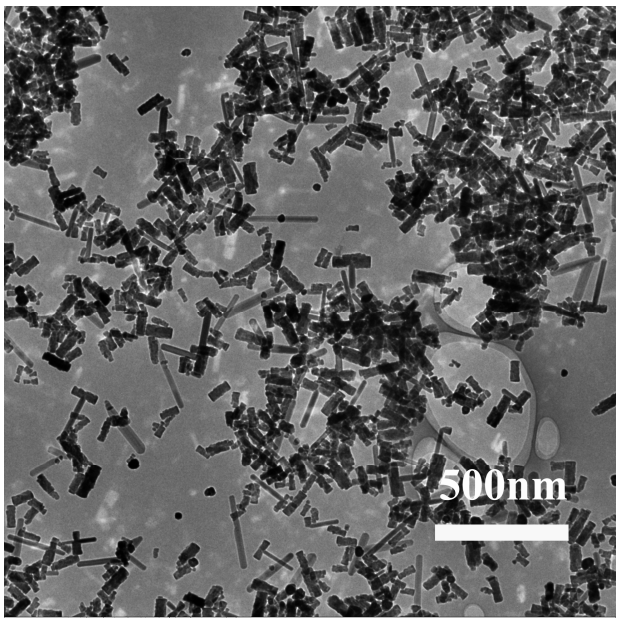

Figure S4. (contrast S1) TEM image of the precursors of short nanorods.