Supporting Information

Epitaxial patterned Bi_2FeCrO_6 nanoisland arrays with room temperature multiferroic properties

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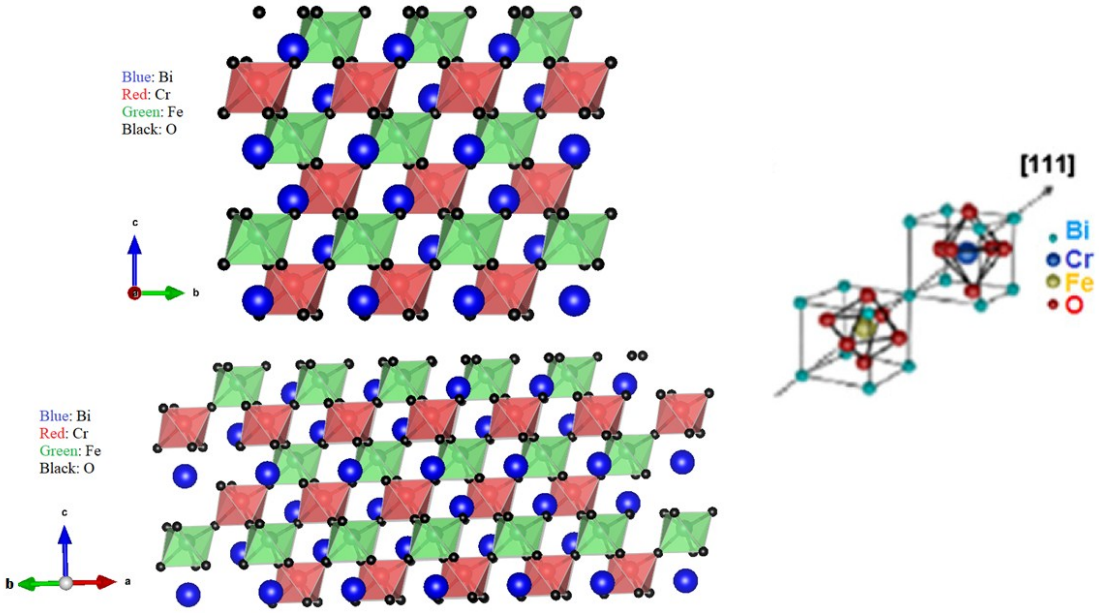

Figure. S1. Left: Crystal structure of the double perovskite Bi_2FeCrO_6 from different perspectives. O and Bi atoms are denoted by the smallest ball with black and the biggest ball with blue, respectively. Fe and Cr octahedra are colored green and red, respectively. Right: double-perovskite structure involved in perovskite Bi-Fe-O and perovskite Bi-Cr-O unit cells, along Fr-Cr ions [111] direction. Adapted from ref. **1**.

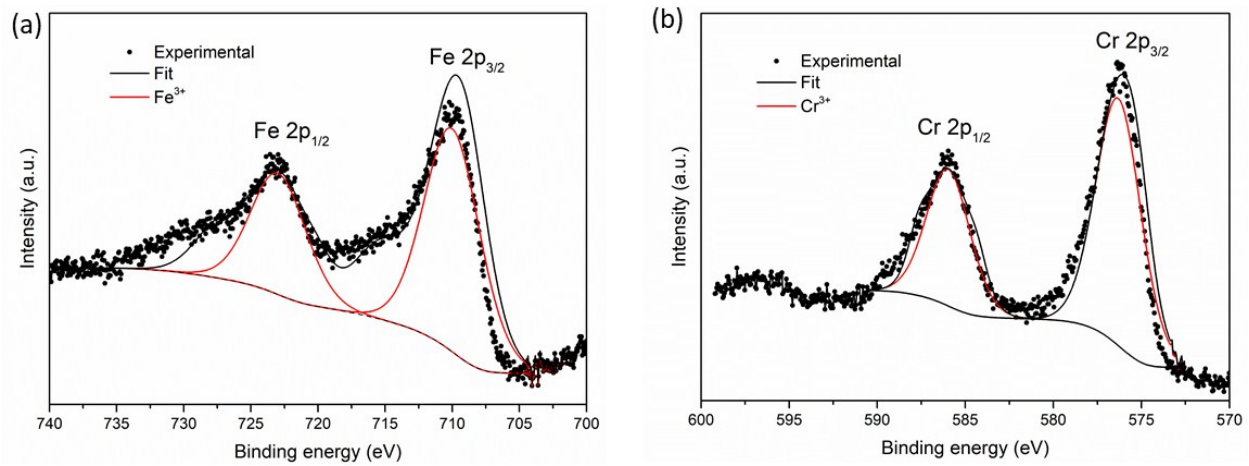

Figure S2. X-ray photoelectron spectroscopy (XPS) of (a) Fe 2p and (b) Cr 2p lines for BFCO patterned nanostructures on Nb-$SrTiO_3$ (100) substrate.

The Fe 2p XPS spectra reveal the $2p_{3/2}$ and $2p_{1/2}$ doublets arising from spin-orbit splitting (Fig. S2(a)). The binding energies for $Fe2p_{3/2}$ and $Fe2p_{1/2}$ peaks are about 710.1 and 723.2 eV, respectively. From the Fig. S2(a) we deduce that the oxidation state of Fe in our BFCO/NSTO nanostructures is Fe^{3+}. The Cr 2p XPS spectra reveal the $2p_{3/2}$ and $2p_{1/2}$ doublets arising from spin-orbit splitting (Fig. S2(b)). The binding energies for $Cr2p_{3/2}$ and $Cr2p_{1/2}$ peaks are about 576.4 and 586.2 eV, respectively, implying that the oxidation state of the Cr ion on BFCO is Cr^{3+}.[2]

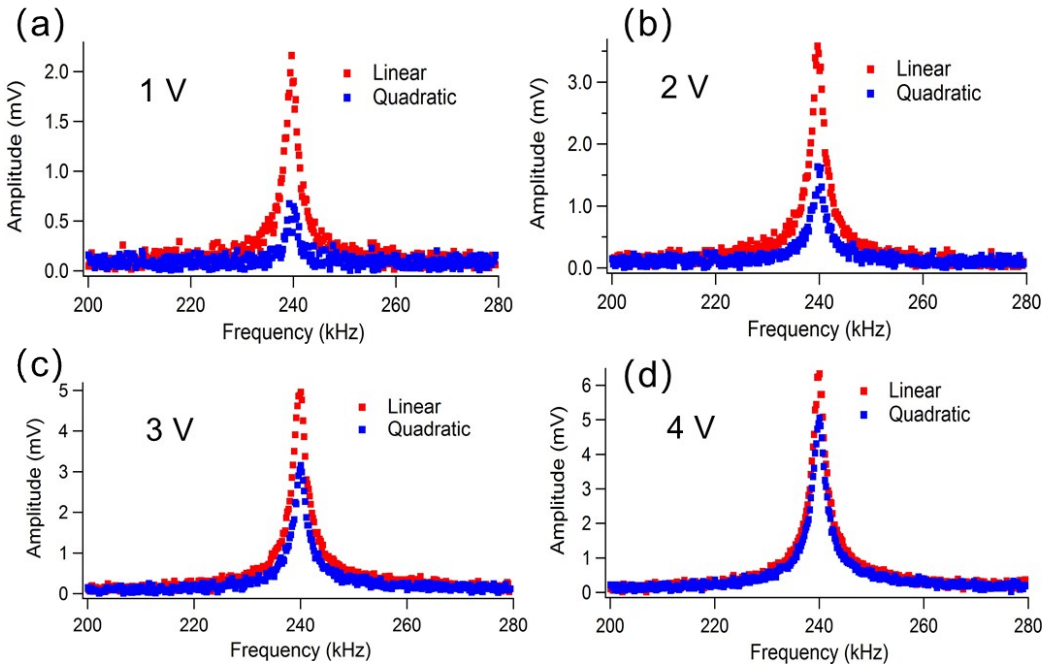

Figure S3. The first and second harmonic PFM responses of BFCO nanoisland under (a) 1, (b) 2, (c) 3, and (d) 4 V AC excitation.

Reference:

1 R. Nechache, F. Rosei, J. Solid Stat. Chem., 2012, **189**, 12.

2 R. Nechache, C. V. Cojocaru, C. Harnagea, C. Nauenheim, M. Nicklaus, A. Ruediger, F. Rosei and A. Pignolet, *Adv. Mater.*, 2011, **23**, 1724.