# Supporting Information

Self-assembly growth strategy for highly ordered ferroelectric nanoisland array

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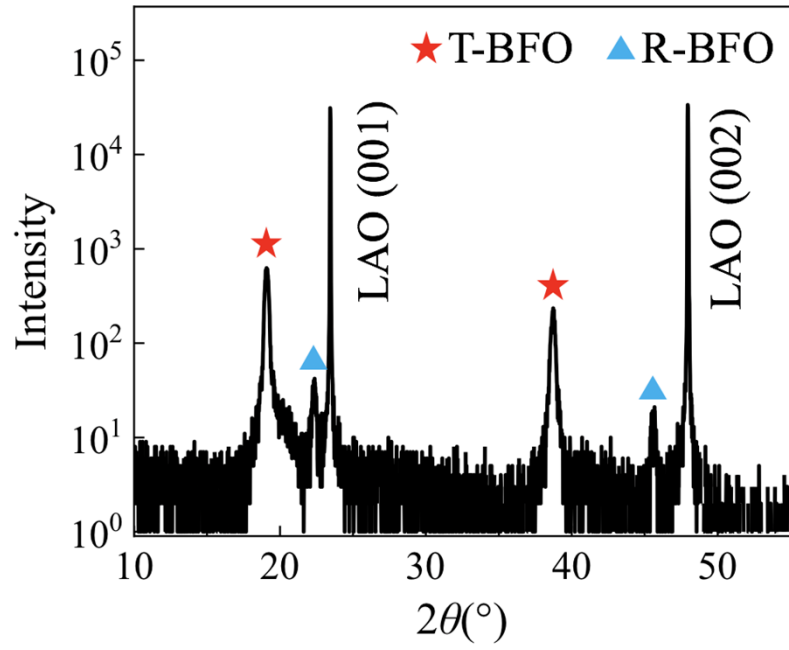
Fig. S1. θ-2θ diffraction pattern of BFO/LSMO film grown on patterned LAO substrate.
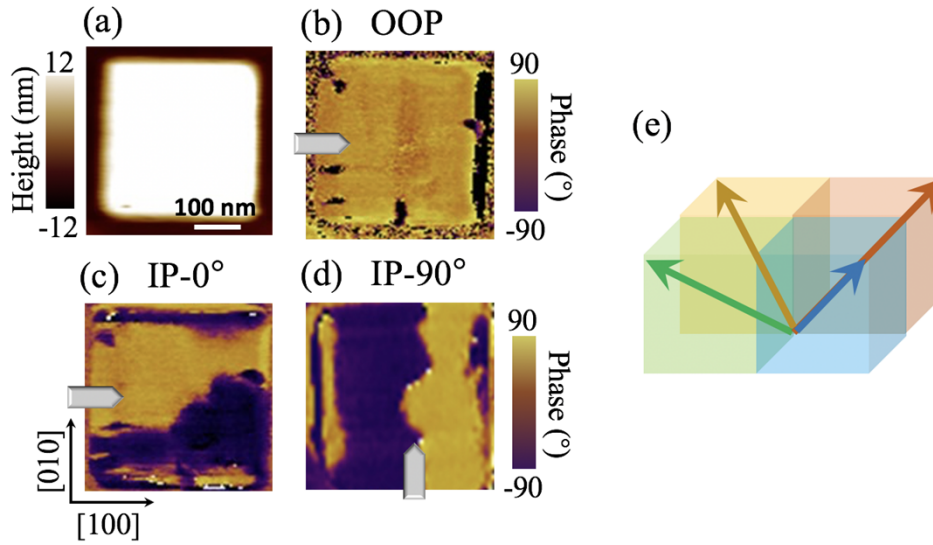
Fig. S2. Ferroelectric domain structures of a single BFO nanoisland grown on the nanocavity. (a) AFM image. (b) OOP phase image. (c) IP-0° phase image. (d) IP-90° phase image. The gray arrows in PFM images represent the cantilever of the scanning probe. IP-0° and IP-90° phase images were measured with the cantilever parallel and perpendicular to [100] direction of LAO substrate, respectively. (e) 3D schematic of ferroelectric domain structure reconstructed by PFM images, which is a center-divergent quad-domain configuration. The arrows represent the polarization vectors.
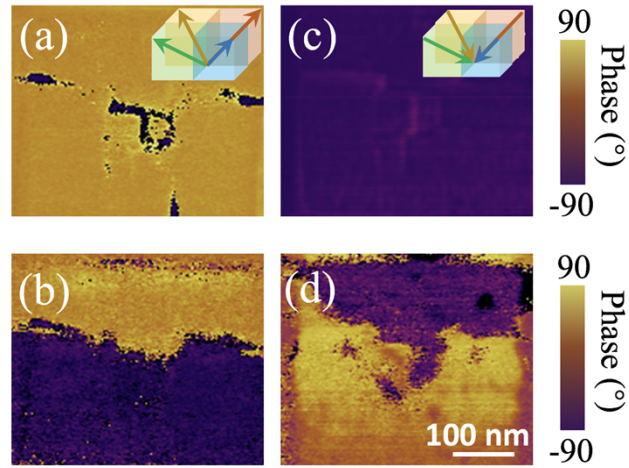
Fig. S3. Switching characterization of BFO nanoislands on nanocavities. Pristine (a) OOP and (b) IP-0° phase images of a BFO nanoisland. (c) OOP and d) IP-0° phase images of the same BFO nanoisland after switched by +7.3 V bias applied on AFM tip (sample was grounded). Insets are 3D schematics of ferroelectric domain structures before and after switching, with arrows representing the polarization vectors.
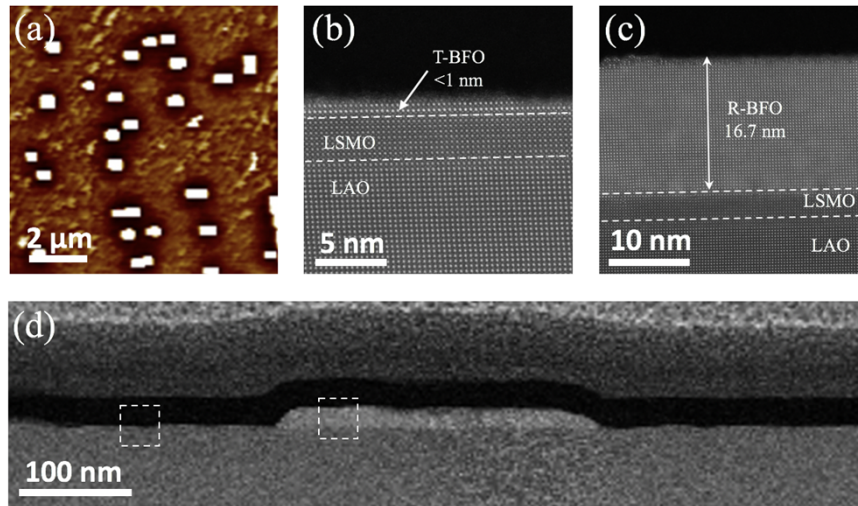
Fig. S4. Structure of BFO nanoislands grown on LSMO/LAO heterostructure at the early growth stage (300 pulses). (a) AFM image of BFO nanoislands. STEM images of (b) the T-phase matrix and (c) the R-phase nanoisland, corresponding to the two white dashed boxes labeled in (d) the low-magnification STEM image.
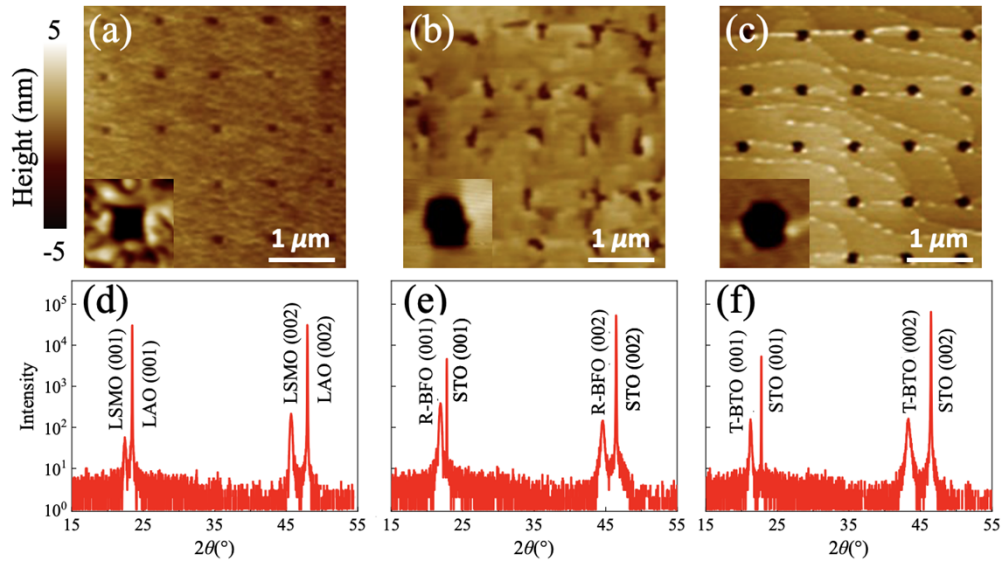
Fig. S5. AFM images and θ-2θ diffraction pattern of perovskite oxides grown on patterned substrates. (a, d) LSMO/LAO (001), (b, e) BFO/LSMO/STO (001) and (c, f) BTO/STO (001). Insets are close-up images of a single nanostructure (200×200 nm).