Supplementary

Growth and improved magnetoelectric response of strain modified Aurivillius SrBi$_{4.25}$La$_{0.75}$Ti$_4$FeO$_{18}$ thin films

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Fig. S1 (a) GIXRD scans of SBLFT/Pt/TiO$_2$/SiO$_2$/Si thin films grown at optimized conditions of 560 °C at 100-mTorr oxygen partial pressure with different thicknesses. (b) Pole figure for SBLFT grown at 560 °C.
Fig. S2 Grain morphology of SBLFT thin films, observed by FESEM, for samples with a thickness of (a) 80 nm, (b) 120 nm and (c) 330 nm and (d) ceramic SBLFT target used for thin film deposition.
Fig. S3 Ferroelectric – paraelectric phase transition ($T_C$) is at 340 °C and high temperature maxima ($T_m$) is at 470 °C. This $T_m$ can be related to the ferroelastic – paraelastic phase transition.
Fig. S4 EELS spectrum displaying the Bi-N\textsubscript{4,5}, Ti-L\textsubscript{2,3}, O-K; Fe-L\textsubscript{2,3}, and La-M\textsubscript{4,5} edges.
Fig. S5 (a) STEM ADF micrograph. The green square highlights the area used to perform the SR-EELS analysis. (b) DF micrograph acquired simultaneously as the SR-EELS spectra (c) Bi chemical map (d) EELS spectrum displaying the Bi-M$_{4,5}$ edges.
Fig. S5 (e) O/Fe ratio variation close to a nanoregions

Distance (nm)
Fig. S6 (a) Polarization – electric field hysteresis loops of SBLFT thin films with different thickness and (b) $P_r$ and $E_C$ relation as a function of thickness.