Electronic Supplementary Information

Figure S1 (a) Bipolar P-E loops; (b) Bipolar S-E loops for BF-BT-xNLN ceramics.
Figure S2. Frequency-dependent permittivity and loss curves for BF-0.3BT-xNLN with (a) x=0, (b) x=0.005, (c) x=0.01, (d) x=0.02 and (e) x=0.03; (f) Temperature-dependent permittivity and loss curves at 100 kHz for BF-BT-xNLN ceramics.
Figure S3. (a) $\{111\}_p$ and (b) $\{200\}_p$ XRD reflections at 0 and 60 kV cm$^{-1}$ for BF-0.3BT at $\beta = 0^\circ$; d-spacing and FWHM of (c)$\{111\}_p$ and (d) $\{200\}_p$ XRD reflection at $\beta = 0^\circ$ obtained from the in-situ XRD experiment for BF-0.3BT, with two cycles of electric field poling under $\pm$ 60 kV cm$^{-1}$.
Figure S4. Contour plots of the {111}, {200} and {220} peak profiles at (a) $\beta = 0^\circ$ and (b) $\beta = 90^\circ$ obtained from the in-situ XRD experiment for BF-0.3BT-0.005NLN, with two cycles of electric field poling under $\pm 60$ kV cm$^{-1}$; effective lattice strains calculated from representative peaks with grain orientations of (c) $\beta = 0^\circ$ and (d) $\beta = 90^\circ$ for BF-0.3BT-0.005NLN; (e) Total estimated macroscopic strain for $\beta = 0^\circ$ and $\beta = 90^\circ$ for BF-0.3BT-0.005NLN; (f) Directly measured macroscopic S-E loop for BF-0.3BT-0.005NLN.
Figure S5 Contour plots of the {111}, {200} and {220} peak profiles at (a) $\beta = 0^\circ$ and (b) $\beta = 90^\circ$ obtained from the in-situ XRD experiment for BF-0.3BT-0.02NLN, with two cycles of electric field poling under $\pm 60 \text{ kV cm}^{-1}$; Effective lattice strains calculated from representative peaks with grain orientations of (c) $\beta = 0^\circ$ and (d) $\beta = 90^\circ$ for BF-0.3BT-0.02NLN; (e) Total estimated macroscopic strain for $\beta = 0^\circ$ and $\beta = 90^\circ$ for BF-0.3BT-0.02NLN; (f) Directly measured macroscopic S-E loop for BF-0.3BT-0.02NLN.
Figure S6. (a) $\{111\}_p$ and (b) $\{200\}_p$ XRD reflections at 0 and 60 kV cm$^{-1}$ for BF-0.3BT-0.03NLN at $\beta = 0^\circ$; d-spacing and FWHM of (c) $\{111\}_p$ and (d) $\{200\}_p$ XRD reflection at $\beta = 0^\circ$ obtained from the in-situ XRD experiment for BF-0.3BT-0.03NLN, with two cycles of electric field poling under $\pm$ 60 kV cm$^{-1}$. 
Figure S7 Effective lattice strains calculated from representative peaks with grain orientations of (a) $\beta = 0^\circ$ and (b) $\beta = 90^\circ$, obtained from the in-situ XRD experiment for 5\%BiScO$_3$ doped BF-BT ceramics, with two cycles of electric field poling under $\pm$ 50 kV cm$^{-1}$. 

![Graphs showing effective lattice strains with respect to electric field](image-url)
Figure S8 Effective lattice strains calculated from representative peaks with grain orientations of (a) $\beta = 0^\circ$ and (b) $\beta = 90^\circ$, obtained from the in-situ XRD experiment for 5\%BiMg$_{2/3}$Nb$_{1/3}$O$_3$ doped BF-BT ceramics, with two cycles of electric field poling under ± 60 kV cm$^{-1}$.