Supporting information

Buffer Electrode Layers Tuned Electrical Properties, Fatigue Behavior and Phase Transition of KNN-Based Lead-Free Ferroelectric Films

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Fig. S1 (a) The XRD pattern and (b) the enlarged part around (200)$_{pc}$ peak of the KNNLT-M target.

Fig. S2 (a) The photo of real sample with Pt top electrode and (b) Pt electrode physical drawing.
**Fig. S3.** The elemental analysis area and corresponding EDS maps of La, Ni, K, Na, Nb, Ta, Mn and O of KNNLT-M films grown on (a, b-h) LCMO and (k, l-r) LNO buffer electrode layers. The low-magnification and high-resolution cross-sectional images across the bottom interface of KNNLT-M films grown on the (i and j) LCMO and (s and t) LNO buffer electrode layers.
**Fig. S4** (a-d) The detailed room temperature $P$-$E$ hysteresis loops and (e-h) corresponding switching current curves measured at 1 kHz for KNNLT-M films grown on various buffer layer-coated STO (001) substrates under different electrical field.

**Fig. S5.** The comparative phase transition characteristics identified by (a) temperature-dependent dielectric constant and (b) dielectric loss of KNNLT-M films grown on various buffer electrode layer-coated STO (001) substrates.