

Supporting information

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

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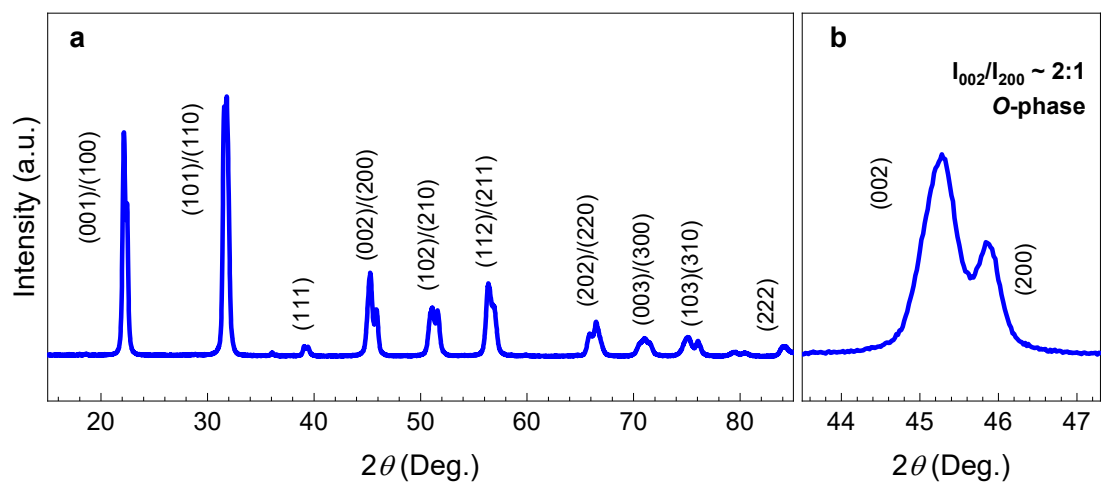


Fig. S1 (a) The XRD pattern and (b) the enlarged part around (200)_{pc} peak of the KNNLT-M target.

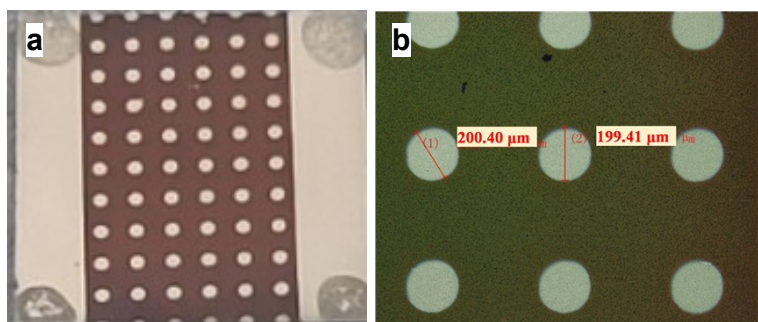


Fig. S2 (a) The photo of real sample with Pt top electrode and (b) Pt electrode physical drawing.

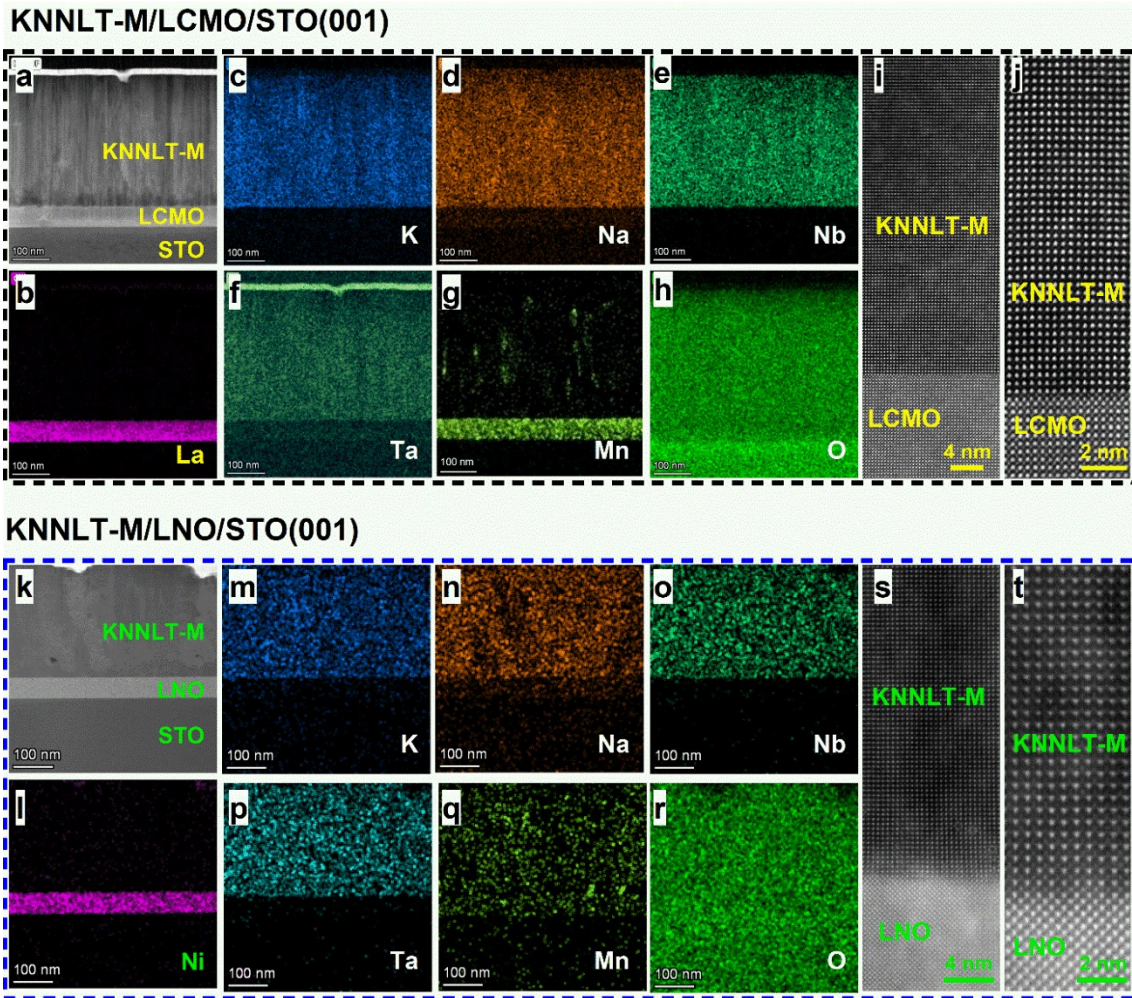


Fig. S3. The elemental analysis area and corresponding EDS maps of La, Ni, K, Na, Nb, Ta, Mn and O of KNNLT-M films grown on (a, b-h) LCMO and (k, l-r) LNO buffer electrode layers. The low-magnification and high-resolution cross-sectional images across the bottom interface of KNNLT-M films grown on the (i and j) LCMO and (s and t) LNO buffer electrode layers.

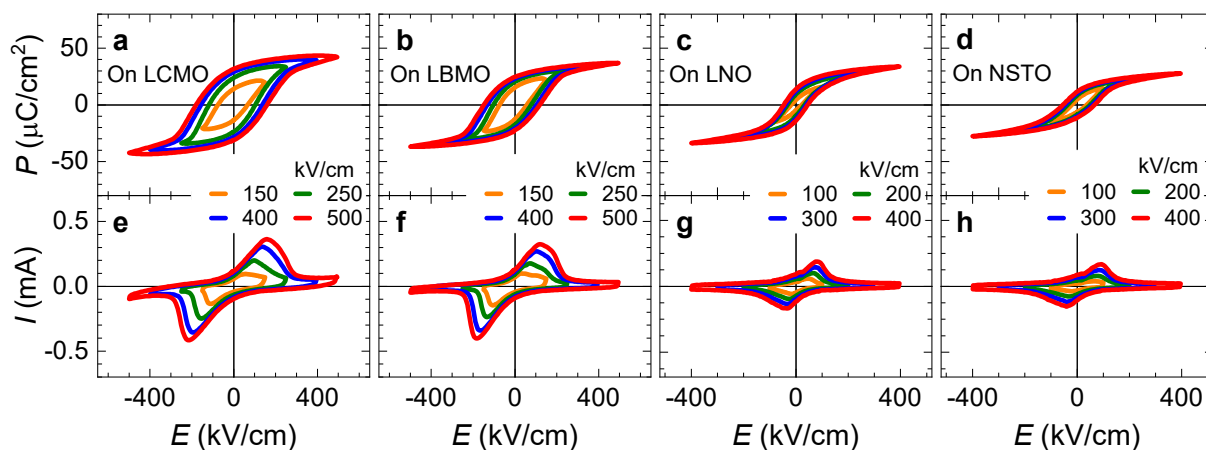


Fig. S4 (a-d) The detailed room temperature P - E hysteresis loops and (e-h) corresponding switching current curves measured at 1 kHz for KNNLT-M films grown on various buffer layer-coated STO (001) substrates under different electrical field.

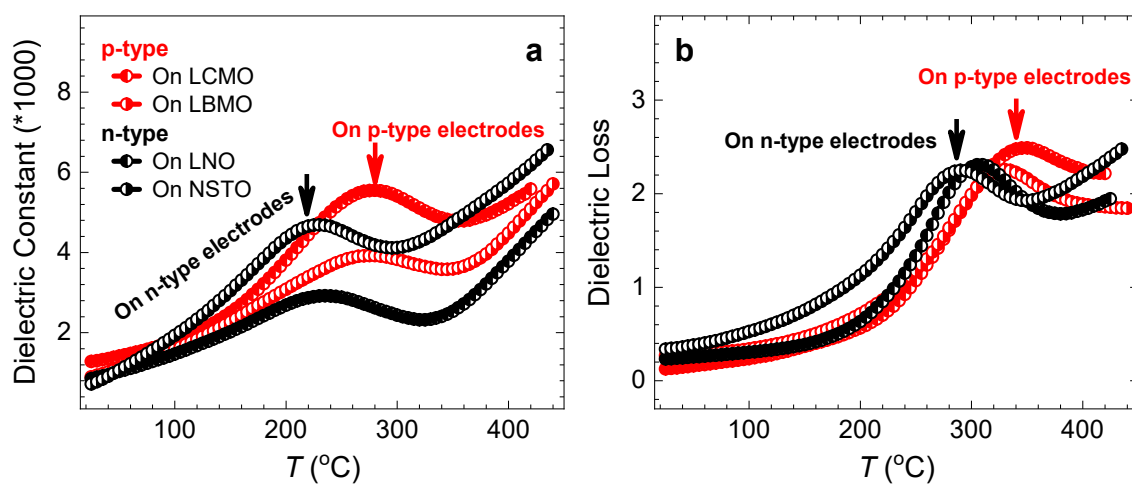


Fig. S5. The comparative phase transition characteristics identified by (a) temperature-dependent dielectric constant and (b) dielectric loss of KNNLT-M films grown on various buffer electrode layer-coated STO (001) substrates.