Supplementary Materials

Figure S1. Polarization ($P$)-electric field ($E$) loops of KNN films deposited on Pt/SrTiO$_3$ (solid line) and Pt/TiO$_2$/SiO$_2$/Si substrates (dash line) measured at room temperature and 50 Hz under electric field up to 45 (a), 60 (b) and 75 kV/cm (c).

Figure S2. Topography (a), out-of-plane PFM signal (b), cross-section profile of topography and PFM amplitude (c) and local piezoelectric hysteresis loops (d) of KNN thin films deposited on Pt/SrTiO$_3$ substrates. No out-of-plane piezoresponse could be obtained for KNN films on Pt/TiO$_2$/SiO$_2$/Si substrates.
Figure S3. Strain \((d_\psi - d_0)/d_0\) of KNN films on Pt/TiO\(_2\)/SiO\(_2\)/Si (open circles) and Pt/SrTiO\(_3\) substrates (solid squares) as a function of \(\sin^2 \psi\) together with linear fits used for stress calculations at room temperature.

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