Supplement

Impact of Bottom Electrode Materials on the Crystallographic Orientation and Ferroelectric Performance of $Al_{0.8}Sc_{0.2}N$ Thin Film

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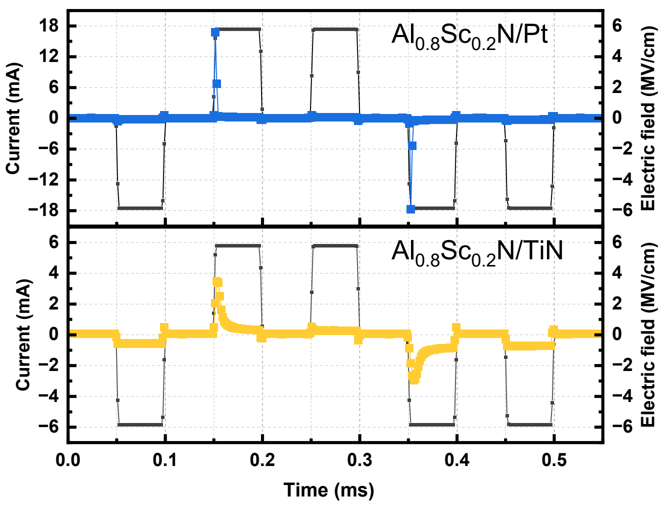
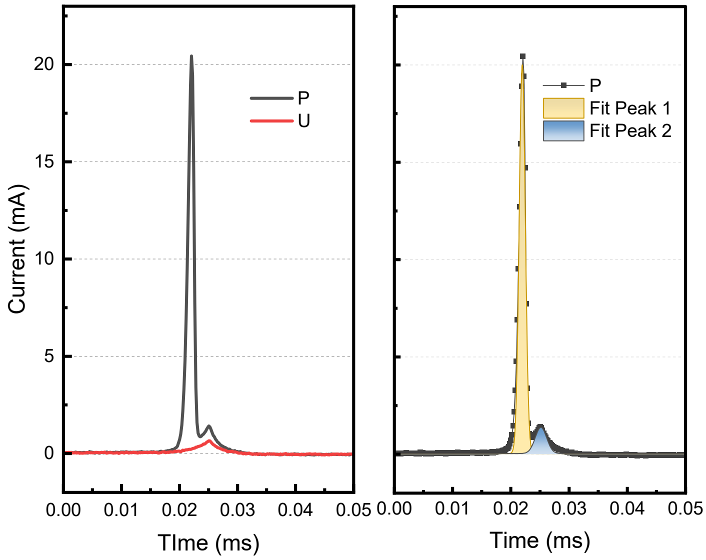


S. 1. Since cyclic loading is a continuous square wave, the electric field used in cyclic loading is much smaller than the maximum electric field of triangular waveform used before in DHM. We use the same pulse width and electric field amplitude as cycling test for the pulse wave positive-up-negative-down (PUND) test to demonstrate effective switching for both samples.



S. 2. Triangular-PUND cannot compensate for the leakage current completely, and an example of P and U pulses is shown in S. 2. Left. To extract a good approximation for the remanent polarization of the films, we compensated I-t in P(N) pulses for the leakage current by peak fitting (See S. 2. Right). Fit peak 1 is considered as ferroelectric current peak. It is worth noting that ferroelectric polarization switching is not a single process, so a single Gaussian peak cannot fully represent the dynamic process. Thus, there is a certain error in peak fitting.

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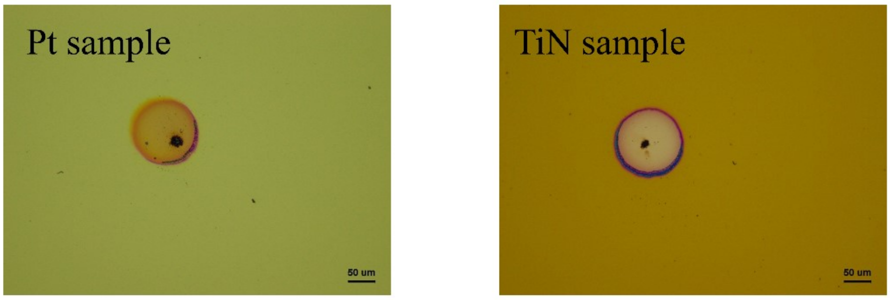

S. 3. Electrode images after faiulre, (left) Pt sample and (right) TiN sample.