

Small Capacitor Measurements using Precision Tester



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Test Configuration

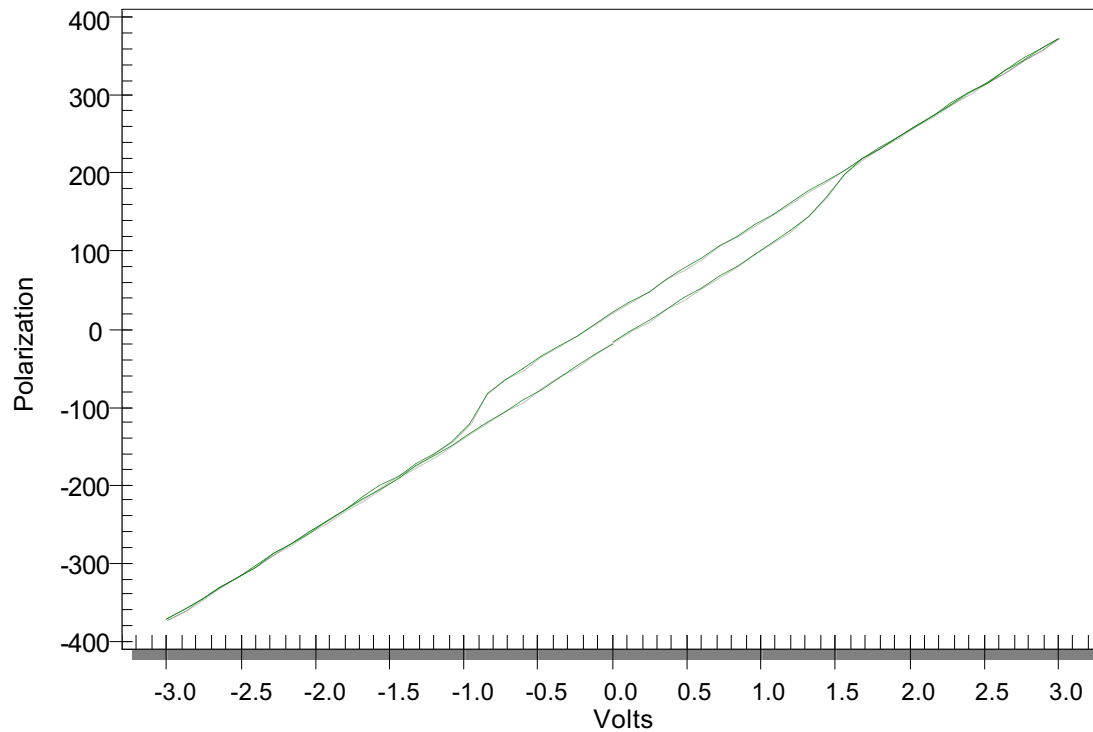
- The capacitors tested consisted of 20/80 PZT on LSCO electrodes. The PZT was nominally 2000Å thick.
- The data was taken primarily on a DI Dimension 3000 AFM head with a Nanoscope III controller. The Small Cap tester was placed on the table with the DI3000 and connected by short coax to the cantilever.
- The Small Capacitor tester was configured for $\pm 10V$ range and could execute hysteresis loops to 2KHz and pulse measurements down to 40 μs .

1 μ^2 Capacitor Results

- The capacitor area was no larger than 1 square micron but, due to erosion of the top electrode during Focused Ion Beam etching, could have been as small as 0.5 square microns.
- We used 1.0 square microns for calculating the polarization of the capacitor during the measurement.
- We measured Hysteresis, PUND vs Volts, IV, and Remanent Hysteresis for this capacitor.

1 μ^2 Hysteresis (As measured)

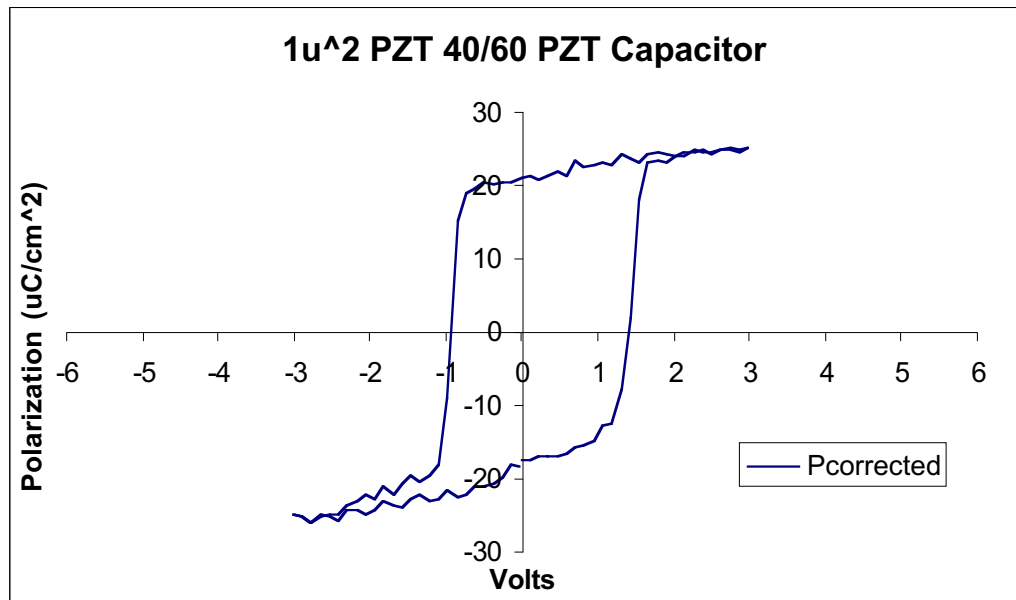
Average +Hyst for NVV46 1 μ^2 Capacitor
[2000A 40/60 PZT on LSCO]



- 1Khz at $\pm 3V$. Averaged 5 times.

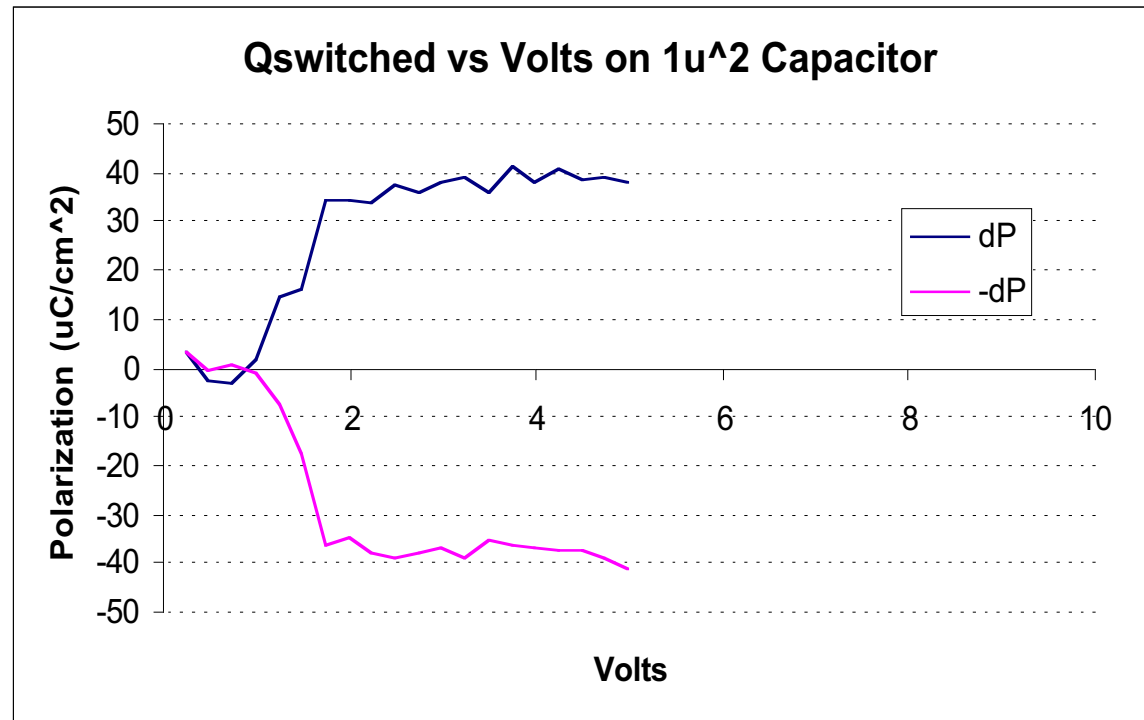
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1 μ^2 Hysteresis (Corrected for Parasitics)



- 1Khz at $\pm 3V$. Averaged 5 times.

1 μ^2 deltaP vs Volts

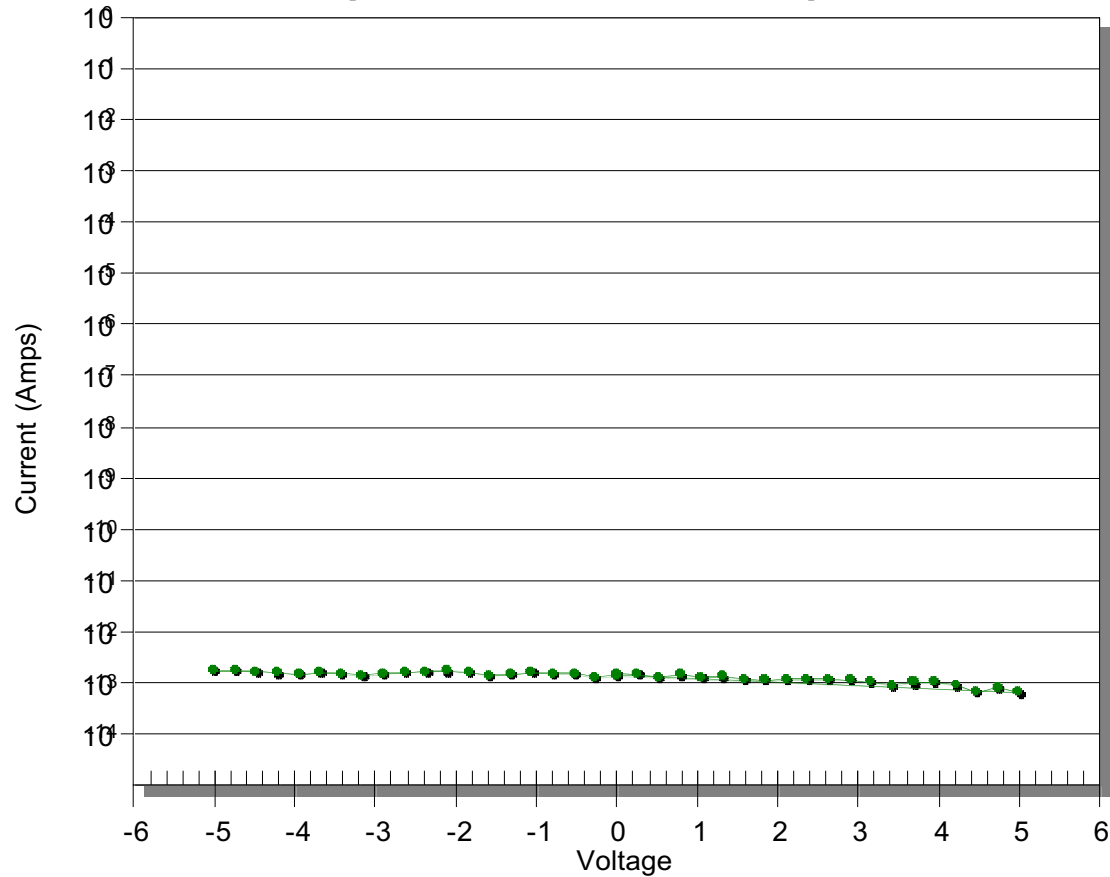


- 100 μ s pulse widths. One second between pulses. Voltages from 0.25V to 5V in 0.25V steps. dP for the Radiant PUND test is equivalent to Qswitched.

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1 μ^2 Leakage

Unswitched I/V of NVV46 1 μ^2 Capacitor
[2000A 40/60 PZT on LSCO Electrode]

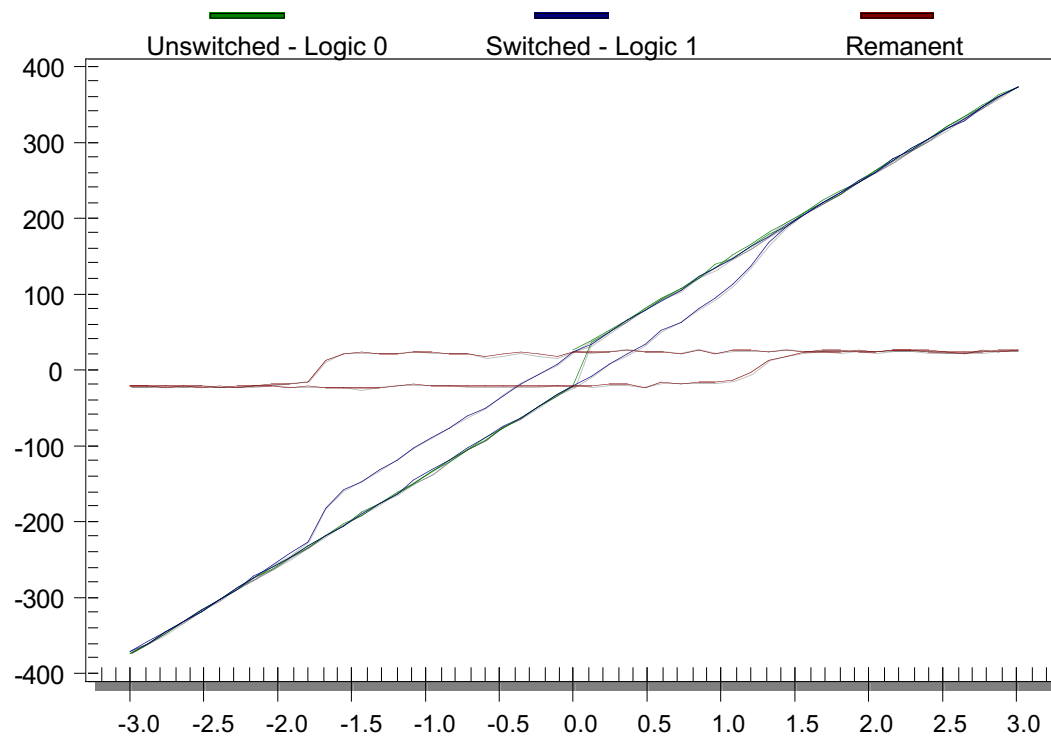


- 10 second integration time. Switching and non-switching results are identical.

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1 μ^2 Remanent Hysteresis (As Measured)

Remanent Hysteresis Measurement of NVV46 1 μ^2 Sample
[2000A 40/60 PZT on LSCO]

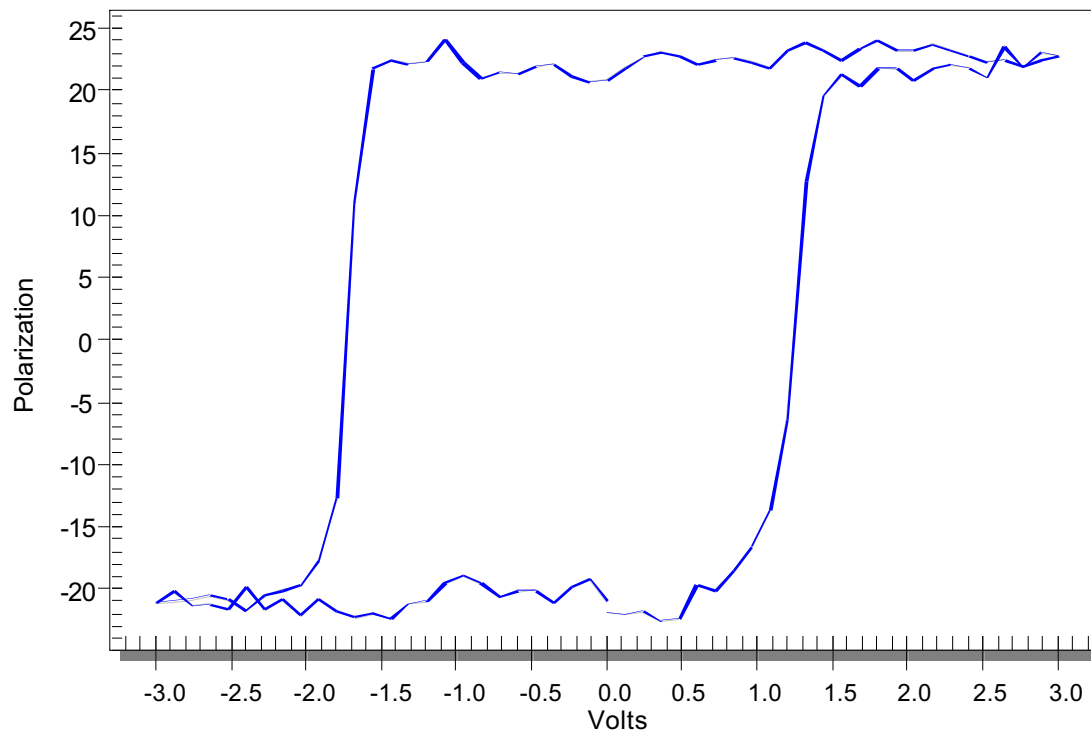


- 1Khz at $\pm 3V$. Single measurement with no averaging.

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1 μ^2 Remanent Hysteresis (Averaged 5 times)

Average Remanent Hysteresis of NVV46 1 μ^2 Capacitor
[2000A 40/60 PZT on LSCO Electrode]



1Khz at $\pm 3V$. Averaged 5 times.

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Data herein is proprietary to Radiant Technologies,

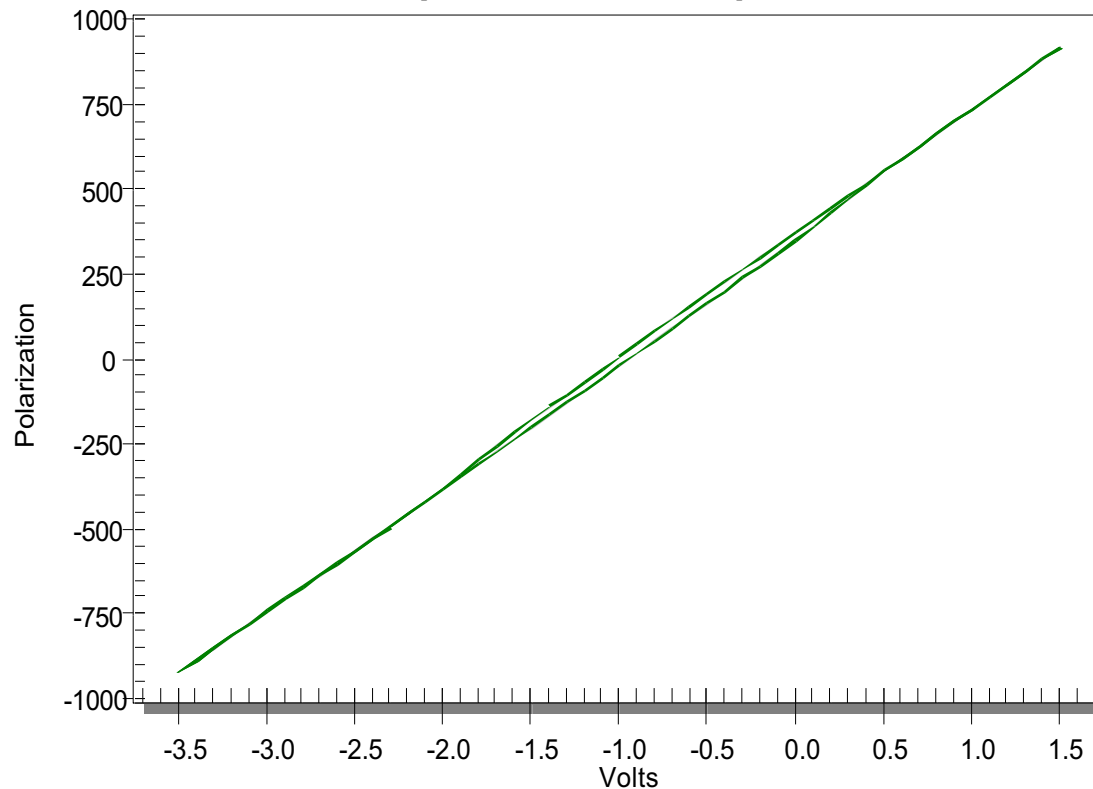


0.33 μ^2 Capacitor Results

- The capacitor area was no larger than 0.33 square microns but may have been smaller due to erosion of the top electrode during Focused Ion Beam etching. We conducted a study of the topology of the top electrode using the AFM and estimated the actual top electrode area to be approximately 0.1 square microns.
- We used 0.33 square microns for calculating the polarization of the capacitor during the measurement.
- The capacitor was measured from hysteresis.

0.33 μ^2 Hysteresis (As measured)

Average -Hyst for NVV46 0.33 μ^2 Capacitor
[2000A 40/60 PZT on LSCO]

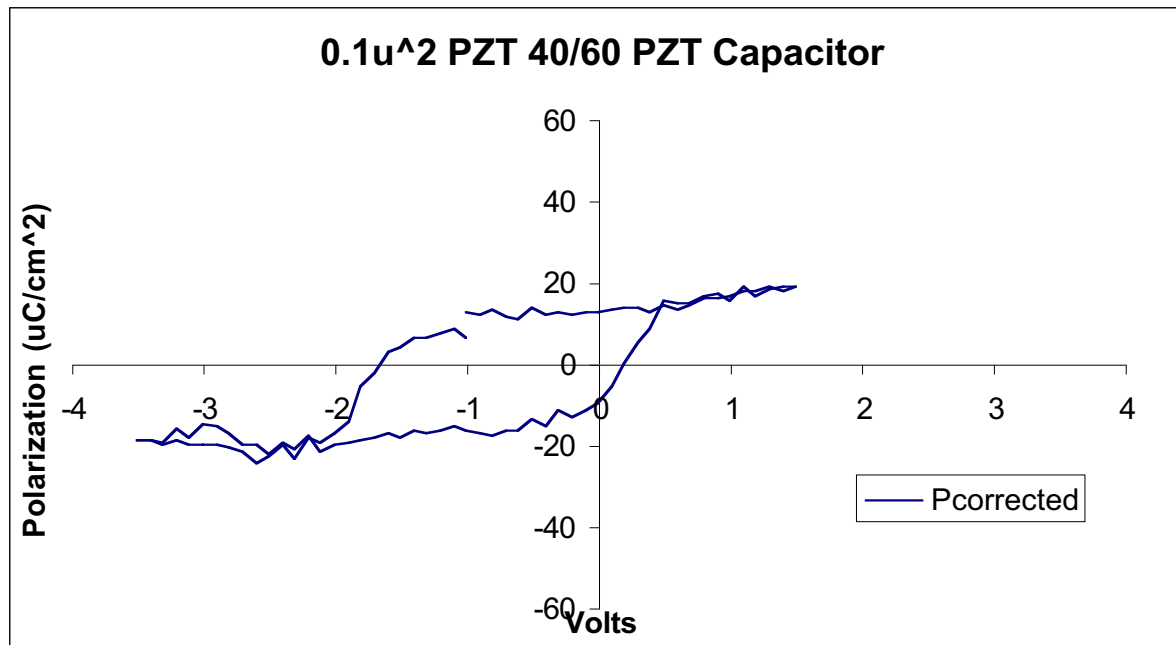


- Averaged 20 times.

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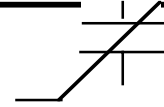
0.33 μ^2 Hysteresis

(After eliminated parasitics)



- Averaged 20 times. The capacitor appears to have a built-in offset, probably a by-product of the FIB etching procedure.

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Acknowledgements

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