Ferroelectric Properties of Off-Stoichiometric BaTiO$_3$ Thin Films

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Background/Relevance
- Barium titante (BTO) is a ferroelectric material with giant polarization, dielectric constant and surface charge.
- BTO is tunable with electric field, strain, light and composition.

Innovation
- Using quantitative PFM to compare the ferroelectric strength of off-stoichiometric BTO is a unique approach.
- Exploring the material properties will allow us to understand what affects the ferroelectric strength and what phase BTO prefers to grow in.

Key Results
- Grown 40nm thick BTO samples with variety of structural phases.
- Off-stoichiometric samples are phase pure.
- Can quantitatively compare ferroelectricity.

Approach
- Use Molecular Beam Epitaxy (MBE) to grow 40 nm films varying composition of Ti/Ba form 0.67 to 1.23.
- Measure strength of ferroelectricity using piezoforce microscopy.

Conclusions
- Can grow a wide variety of surface stoichiometries and structural phases of BTO using shuttered RHEED technique.
- For a wide variety of Ti/Ba shutter times, structural phase of stoichiometric BTO seems to be preferred.
- Ferroelectricity exists in comparable strength for a wide range of off-stoichiometric BTO.

Future Work
- Investigate defects and growth mechanisms using cross-sectional TEM.
- PFM improvement & Standard deviation measurements.