PFM for mapping piezoelectric properties and ferroelectric domain dynamics

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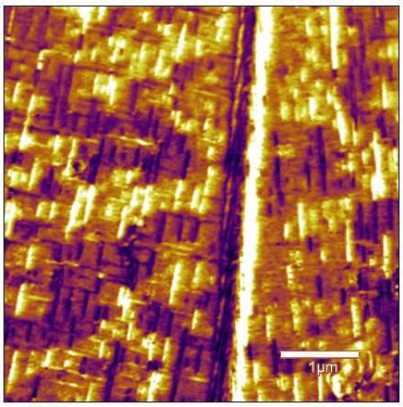
Piezoelectric Force Microscopy has become ubiquitous for investigating epitaxial, thin film, and bulk piezoelectric materials. This includes investigations of piezoelectric coefficients, ferroelectric domain distributions, and polarization switching dynamics. This tutorial will cover the theoretical concepts underpinning standard PFM, contact resonance PFM, lateral and vector PFM, high speed PFM, switching spectroscopy, and resonance tracking PFM. Classis and modern examples of these methods will be presented, along with a review of their various advantages and disadvantages. Necessary instrumentation, helpful analysis tools, optimal specimens, and common challenges will also be discussed. The objective for all participants is to gain a deeper understanding of how to acquire and interpret reliable PFM data for piezoelectric and especially ferroelectric materials.



Lateral PFM of epitaxial (001) PZT near a bicrystal grain boundary, revealing in-plane {100} ferroelastic superdomains. Image courtesy of Ryan Cordier, James Steffes, UConn MSE