Thickness Scaling of Ferroelectricity in Lanthanum-Doped Bismuth Ferrite Nanostructures

Karla Del Cid-Ledezma, Will Linthicum, William P. Huey, Bryan D. Huey

Institute of Material Science, University of Connecticut

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Introduction

- Need to identify materials for Beyond-CMOS devices that facilitate:
  - High processing speed
  - High memory density
  - Low consumption of power
  - Non-volatile
  - Ability to be embedded

Motivation

- Lanthanum-doped Bismuth Ferrite (LBFO) improves the following compared to Bismuth Ferrite (BFO):
  - Ferroelectric properties
  - Structural properties
    - Coercive voltage
    - Domain size
    - Fatigue behavior

Methods

Topography and PFM

Nanopatterning

In situ - Switching

Tomography

Voltage bias

Force
Electric Field induced Switching
High-Force Switching

Amplitude

Phase
High-Force Switching

- We can see the domain switching as the voltage is changed
  - -7V to 0 to -7V again
  - Change happens quickly
Nanopatterning
Nanopatterning and PFM

Progression of PFM signal as nanomachining occurs
Domain Tomography

Grid: 1.9M 40.2^2 x 1 nm^3 voxels
Conclusion and Future works

- Future work would focus on applying a voltage bias to a single mesa with its respective mesa in the row being the control.
Thank you!