Contribution ID: **278** Type: **Oral Presentation**

Surface Brillouin Scattering Characterization of Bismuth Ferrite Thin Films

Tuesday, 30 June 2015 15:20 (20 minutes)

Abstract content
   (Max 300 words)
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BiFeO3 (BFO) is a multiferroic material with excellent magneto-electric properties above room temperature. Despite the intensive research on magneto-electric properties, their mechanical properties in thin film format remain largely unexplored. In this work, surface Brillouin scattering has been used to study the propagation of surface acoustic waves and determine the elastic constants of BiFeO3 thin films on (001) Si prepared by RF magnetron sputtering based on the structural zone model. We apply substrate biasing to induce stress by Ar+ incorporation and determine the effect of stress evolution in BiFeO3 thin films at fixed film composition. X-ray Reflectometry and Grazing incidence X-ray diffraction have been used to determine the deposition rate, interfacial roughness, film density and phase of the crystal of the sample for the extraction of velocity dispersion curves. Atomic force microscope (AFM) yielded low surface roughness values 0.2 to 2.5nm indicating high film quality. Cross-sectional Scanning electron microscope (SEM) revealed a compact granular structure with columnar thin film growth mode. The Rutherford backscattering spectroscopy (RBS) showed a constant non-stoichiometric composition of the films independent of the growth conditions. Applying numerical approaches to fit the velocity dispersion curves, the elastic constants of BiFeO3 thin will be determined.
Keywords: elastic constants, multiferroic, surface Brillouin scattering, x-ray reflectometry

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Session Classification: DPCMM

Track Classification: Track A - Division for Physics of Condensed Matter and Materials