Abstract Submitted
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Nonlinearity in the high-electric-field piezoelectric response of epitaxial BiFeO3[1] PICE CHEN, REBECCA SICHEL[2], JIYOUNG JO[3], RYAN SMITH, CHANG-BEOM EOM, University of Wisconsin-Madison, OSAMI SAKATA, SPring-8, ERIC DUFRESNE, Argonne National Laboratory, PAUL EVANS, University of Wisconsin-Madison — The multiferroic material BiFeO3 provides the means to understand the piezoelectric coupling between lattice strain and ferroelectric polarization. Little is known about the piezoelectric properties of BiFeO3 under high electric fields. In our study, the transient high-electric-field piezoelectricity of BiFeO3 was measured at electric fields up to about 300 MV/m using time-resolved x-ray microdiffraction. A linear strain-electric field response with a piezoelectric coefficient of 55 pm/V was observed at electric fields up to 150 MV/m. At higher electric fields, the strain is larger than the value anticipated from the low-field regime, reaching 0.02 at 281 MV/cm. The integrated intensity near the BiFeO3 (002) Bragg reflection is unchanged in large electric fields, showing that the enhanced piezoelectricity occurs without producing a field-induced phase transition. We also observe a relative increase of diffuse x-ray intensity at high electric fields. We will discuss a model in which the increase of piezoelectricity and diffuse scattering originates from the softening of phonon modes at high electric fields.

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