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Experimental observations of grain-scale property coupling in electroceramics

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Fundamental understanding of electro-mechanical properties of ceramics requires detailed multi-length-scale analysis methods. Previously, information of the grain-scale property coupling of elastic strain and domain switching behavior under electric fields has been unobtainable from the bulk of an electro-ceramic material. Here, grain resolved scattering methods have been used to investigate the phase and domain structure of individual grains within bulk polycrystalline electro-ceramic samples under electric field. Example materials are chosen which undergo contrasting strain mechanisms including field-induced phase transformations, and ferroelectric/ferroelastic domain switching.

The data obtained show that the grain orientation with respect to the applied electric field vector dictates both the induced phase and degree of domain texturing observed within a given grain. Such knowledge will be of potential benefit to the future engineering of high-strain actuators, but also has implications for all polycrystalline ferroic materials.

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