Correlation of electron backscatter diffraction and piezoresponse force microscopy for the nanoscale characterization of ferroelectric domains in polycrystalline lead zirconate titanate

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Abstract: The functional properties of ferroelectric ceramic bulk or thin film materials are strongly influenced by their nanostructure, crystallographic orientation, and structural geometry. In this paper, we show how, by combining textural analysis, through electron backscattered diffraction, with piezoresponse force microscopy, quantitative measurements of the piezoelectric properties can be made at a scale of 25 nm, smaller than the domain size. The combined technique is used to obtain data on the domain-resolved effective single crystal piezoelectric response of individual crystallites in Pb(Zr 0.4Ti0.6)O3 ceramics. The results offer insight into the science of domain engineering and provide a tool for the future development of new nanostructured ferroelectric materials for memory, nanoactuators, and sensors based on magnetoelectric multiferroics.

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