In-situ Electric Field Synchrotron Diffraction of $PbZr_{(x)}Ti_{(1-x)}O_3$ Microdomains

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The structure of $PbZr_xTi_{1-x}O_3$ at its morphotropic phase boundary (MBP) and the influence of electric field on the domain structure in this area have been the subject of controversy. While Noheda et al. [1] proposed a monoclinic "bridging" phase at the MPB without considering the real structure, Jin et al. [2] describe an adaptive phase of tetragonal microdomains in relaxors, which are not resolvable with X-rays and therefore only appear to be of monoclinic symmetry.

In this work, a correlation is drawn between these two models, and the variation of the domain structure with composition and electric field is investigated. Rietveld refinement and analysis of ex-situ and in-situ electric field high-resolution synchrotron X-ray diffraction data of polycrystalline pellets (~60µm), measured in transmission geometry, and TEM studies indicate various changes in domain structure across the MPB. A lowering of the domain wall energy by a decrease in c/a-ratio of the tetragonal phase with lower Ti fraction leads to a simultaneous increase in content of microdomains – the adaptive phase, which has a tremendous influence on the poling behaviour of the material.

[1] Noheda B., Gonzalo J.A., Cross L.E., Guo R., Park S.E., Cox D.E., Shirane G., *Phys. Rev. B*, 2000, **61**, 8687. [2] Jin Y.M., Wang Y.U., Khachaturyan A.G., Li J.F., Viehland D., *Phys. Rev. Lett*., 2003, **91**, 197601.

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