domains in an isotropic arrangement. There are also other weaker patterns with axial symmetry about the Bragg rod. Application of a field brings about large changes. The diffuse scattering becomes much more diffuse, apparently involving a migration closer to the film Bragg peak, evidence of an increased spread in domain size and domain disorder. After removing the field the domain distribution does not relax back to the initial state, presumably reflecting the influence of domain wall pinning in stabilizing a field-induced domain geometry.

Keywords: synchrotron X-ray scattering, perovskite oxides, thin ferroelectric films

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Effect of doping on the poling behaviour of $PbZr_xTi_{1-x}O_3$ under electric field

Manuel Hinterstein, Kristin A. Schoenau, Hartmut Fuess
TU Darmstadt, Material Science, Petersenstrasse 23, Darmstadt, Hessen, 64287, Germany, E-mail：manuel.hinterstein@desy.de

Lead zirconate titanate $PbZr_xTi_{1-x}O_3$ (PZT x/1-x) ceramic is one of the most important perovskite ferroelectric material for application in various sensors and actuators. Especially, the solid solution composition located near the rhombohedral-tetragonal morphotropic phase boundary (MPB) possesses eminent piezoelectric characteristics and is widely utilized in a donor or acceptor doped modification with improved electrical properties. Here in particular samples doped with either lanthanum or iron of compositions at the morphotropic phase boundary are investigated, as they depict highest strain values under electric field compared to single phase tetragonal (*P*4*mm*) or rhombohedral (*R*3*m*) compositions. We have been able to show changes in phase fractions, domain structure and phase transitions under electric field dependent on the nanodomain content in recent work for undoped PZT [1,2,3,4]. To extend the analysis of in-situ data under electric field we have performed full pattern Riet-veld analysis of diffraction patterns recorded in transmission mode in-situ under electric field at the beamline B2 at Hasylab in Hamburg. The investigation of the domain structure and its alteration under the influence of an applied electric field was of special interest. The results can be correlated with undoped PZT with respect to the alteration of the properties and the reaction to an electric field. We can therefore say that already very small amounts of dopants can have a very pronounced effect on the behaviour of PZT under applied electric field.

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Keywords: lead zirconate titanate, X-ray diffraction, domain structure

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Structural study of ferroelectric/relaxor multilayers of the $(1-x)PbMg_{1/3}Nb_{2/3}O_3$ - $(x)PbTiO_3$ family

Eric Dooryhee[1], Francoise Le Marrec[2], Nathalie Lemee[2], H Bouyanfif[2], Mickael Karkut[2], Maud Nemoz[1,3], Jean-Louis Hodeau[1]
[1]Institut Neel - CNRS - University Joseph Fourier, MCMF, 25 av. des martyrs - BP 166, Grenoble, France, 38042, France, [2]LPMC, Universite de Picardie Jules Verne, 33 rue St Leu, 80039 Amiens, France, [3]CRHEA, Rue Bernard Gregory 06560 Valbonne, France, E-mail：eric.dooryhee@grenoble.cnrs.fr

The complex oxide ferroelectric materials [(1-x)PMN - xPT] have generated a great deal of interest due to their exceptional electromechanical coupling in single crystal form, thus their fabrication as thin films is important for practical applications. Since the microscopic origin of these exceptional piezoelectric properties seems to be directly linked to the complex nanostructure of the material, it is fundamental to understand the influence of strain in these materials, when they are in the form of films and heterostructures. In order to investigate the effect of strains and interactions between the relaxor PMN and the ferroelectric PT, we grew a series of [PMN(1-x)L/PTxL]10 superlattices [1] on buffered MgO substrates, with x varying between 0.2 and 0.9; the modulation period L nominally is 150Å. Here we report on both the out-of-plane and the in-plane structures of PMN and PT layers as a function of x. We show the interlayer structural coupling between the relaxor PMN and the ferroelectric PT in PMN/PT superlattices. The effects of strains in such superlattices generate structural patterns in these materials that are not ordinarily achievable in thin films, and can also provide a way to control the polarization axis in very thin ferroelectric layers. The presence of a1 and a2 domains is expected since this type of domain structure is usually observed in PT thin films. These polydomain patterns result from the strain relaxation at the substrate/ferroelectric film interface and are thickness dependent [2]. To our knowledge, it is the first time that this domain structure is observed in superlattices.

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Short and long-range order structure in the $Pb_{1-x}La_xTiO_3$ (x = O.20 and 0.30) ferroelectric ceramics

Antonio C. Doriguetto[1], Person P Neves[1], Felipe T Martins[1], Mirta Mir[1], Valmor R Mastelaro[2], Yvonne P Mascarenhas[2], Jose A Eiras[3]
[1]Federal University of Alfenas - UNIFAL-MG, Exact Science Departament, Rua Gabriel Monteiro da Silva, 714, Alfenas, Minas Gerais, 37130-000, Brazil, [2]Instituto de Fisica de Sao Carlos - USP, Sao Carlos, SP, Brazil, [3]Departamento de Fisica, Universidade Federal de Sao Carlos, Sao Carlos - SP, Brazil, E-mail：doriguetto@unifal-mg.edu.br

Lanthanum-doped lead titanate ceramics ($Pb_{1-x}La_xTiO_3$ or PLTx) is a family of ferroelectric compound which have been studied in detail due to their interesting technological properties. The isomorphic substitution of Pb in $PbTiO_3$ by La atoms induces significant changes in its electrical properties. We have studied the long and short-range order structure of the PLT and its dependence with the normal and relaxor behaviour presented on PLT ceramics with x=0.20 (normal ferroelectric) and x=0.30 (relaxor ferroelectric) by in-situ XRD and XAS techniques above and below T_C and T_m respectively. The PLT20 XRD patterns were measured on a Rigaku Denki powder diffractometer with geometry 2θ, a rotating anode X-ray source (Cu Kα). The PLT30 XRD patterns were performed at LNLS (Brazilian Synchrotron Light Laboratory). To study the behaviour of the phases as a function of the temperature, some peaks of the PLT30 sample were selected and measured varying the temperature with a step of 10