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Twin Structure of Solid Oxide Electrolytes. Taras Tataryn[a], Dmytro Savytskii[a], Leonid Vasylechko[a], Carsten Paulmann[b,c], Ulrich Bismayer[c]. [a]*Lviv Polytechnic National University, Lviv, Ukraine.* [b]*HASYLAB, DESY, Hamburg, Germany.* [c]*Min.-Petrogr. Institut, Universität Hamburg, Hamburg, Germany.*
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An increasing interest in electrolyte materials for advanced energy applications demands understanding of their *real* structure and its influence on the physical properties. It is therefore relevant to investigate both the crystal- and micro-structures, since the considered properties depend on domain walls and their distribution (twin structures) [1]. ZrO_2 doped with Sc, and $LaGaO_3$ doped Sr and Mg, are considered as prospective solid electrolytes for application in solid oxide fuel cells (SOFCs). The present work is devoted to structure investigations of ZrO_2 doped with 10 mol % Sc_2O_3 (ZSO-10) and $La_{0.95}Sr_{0.05}Ga_{0.9}Mg_{0.1}O_{3-\delta}$ (LSGM-05) and determination their twin structures in their ferroelastic phases.
In order to study the thermal evolution of their crystal structures investigations were carried out at the synchrotron powder diffractometer B2 (HASYLAB/DESY). High-temperature diffraction data were collected in the Debye-Scherrer capillary geometry using the on-line image plate detector OBI and the STOE furnace. Data analysis was carried out by the Rietveld method using the WinCSD program package. Domain orientations were determined by the Laue method. The white beam synchrotron experiments have been carried out using the Kappa-diffractometer at F1 (HASYLAB) equipped with a MAR CCD system and a gas-stream heating device.
The powder diffraction examinations revealed that the rhombohedral structure (space group $R\bar{3}$) of ZSO-10 transforms into the high-temperature cubic structure (space group $Fm\bar{3}m$) at 873 K, while LSGM-05 transforms at 500 K from orthorhombic to monoclinic and at 670 K to rhombohedral phase. Analysis of the Laue patterns confirms that the ZSO-10 crystal was twinned relatively to intersecting (101) and (100)/(001) mirror planes in the rhombohedral phase, while LSGM-05 was twinned relatively to intersecting $(01\bar{1})$ and $(21\bar{1})/(2\bar{1}1)$ mirror planes in the orthorhombic phase. In both crystals the twin structure tends to form typical "chevron-like" wall configurations that allow for a stress-free co-existence of four different orientation states. These four orientation states occur because they perfectly match geometrically and no additional stress occurs at the intersections of domain walls throughout the full temperature range of the corresponding phases [2].The work was supported by WTZ (UKR 07/009) and Ukrainian Ministry of Science (project "Segnet").

[1] M.Kurumada, E.Iguchi, D.Savytskii, *J. Appl. Phys.,* **2006**, 100, 014107. [2] D. Savytskii, U. Bismayer, Phase Transitions, **2008**, 81, 431.

Keywords: crystal structure; ferroelastic; electrolytes

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Molecular Alignment of Ferroelectric Liquid Crystals by Polyimide Thin Film. Ahmet Yildirim[a], Suleyman Yilmaz[a]. [a]*Harran University, Department of Physics, Osmanbey Campus, 63400, Sanliurfa, Turkey.*
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In presented study, the photoinduced alignment of ferroelectric liquid crystals onto photochemically stable polyimide thin films was studied. The molecular alignment quality of ferroelectric liquid crystal display cells depends mainly on the difference between the ferroelectric liquid crystal surface energy and the aligning substrates surface energy; however, the structure and thickness of ferroelectric liquid crystal layers are also very important. The effect of the thickness of photoaligning polyimide thin film on the alignment quality and multiplex operation of passively addressed ferroelectric liquid crystal display cells has been investigated.
This method has been replaced by photoresist coating and etching, whereas other techniques have been used photomask for alignment. The empty cell of liquid crystal is prepared by the attentive procedures in very sensitive conditions and the thickness of cell gap is measured by the rotational interferometric system. This application encouraged and motivated us to further studies, which will be applied by lithograph application by changing on the UV exposing time and the percentage of the chemical etching.

Keywords: liquid crystals; liquid-crystal displays; ferroelectric materials

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Tensor Distinction of Domains in Ferroic Crystals. Daniel B. Litvin. *Penn State Berks P.O.Box 7009, Reading, PA 19610-6009, USA.*
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Ferroic crystals contain two or more domain states and may be distinguished by the values of components of tensorial physical properties of the domains. We extend Aizu's global tensor distinction of all domains which arise in a ferroic phase transition from phases invariant under time reversal to include those domains which arise in transitions from magnetic and non-magnetic phases. For determining possible switching of domains, a domain pair tensor distinction is also given for all pairs of domains which arise in each ferroic phase transition.

Keywords: ferroic domain structures; domain switching; physical properties electrical magnetic

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Ferroelectric Properties and Structural Relationship in $BaSc_{1/2}Ta_{1/2}O_3$-$BaTiO_3$ System. Kamel Taïbi[a], Nouari Bensemma[b], Ahmed Kerfah[a], Achoura Guehria-Laidoudia[a], Annie Simon[c]. [a]*Faculté*