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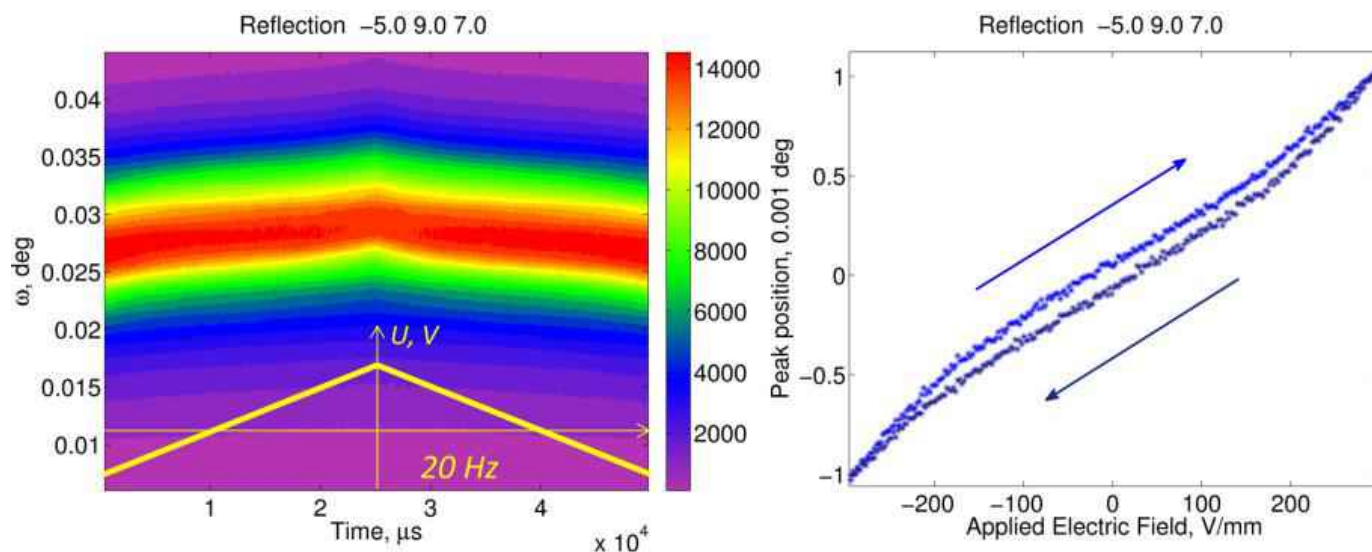
Atomic, strain and domain dynamics in ferroelectrics under cyclic electric field

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Structural dynamics is a subject of a recent interest in solid state physics and a challenge for modern X-ray crystallography. Time-dependent response of solids to an external perturbation on atomic, mesoscopic and macroscopic length scales is the key to understanding many physical properties. We present the data-acquisition system (Gorfman et al., 2013) (DAQ) for X-ray diffraction study of repetitive micro- or millisecond dynamics in a broad range of materials (Gorfman, 2014) under cyclic perturbation. The DAQ operates on the principle of a multichannel analyser: it collects pulses from a single-photon-counting detector and resorts them between 10000 channels. Each channel corresponds to a certain time delay relative to the beginning of a latest perturbation cycle. The width of a channel (temporal resolution of the experiment) can be as small as 10 ns. We investigated atomic, strain and domain dynamics in $\text{SrxBa}_{1-x}\text{Nb}_2\text{O}_6$ single crystals: SBN50 ($x=0.5$, uniaxial ferroelectric) and SBN61 ($x=0.61$, uniaxial relaxor ferroelectric). The experiments questioned the reason for large piezoelectric effect in uniaxial ferroelectrics where 180° (inversion) domains are present, while non- 180° domains are absent. We applied triangular electric field (Figure 1) of variable frequencies and variable strengths. The time and electric field dependence of a set of Bragg rocking curves were followed: intensities, positions and peak widths were analysed giving access to atomic, strain and domain dynamics under external electric field. Figure 1. Left: contour plot of a -5 9 7 Bragg rocking curves from SBN50 single crystal collected under dynamically applied sub-coercive electric field. Right: dynamics of the peak position as a function of applied electric field, showing non-linear and hysteretic behaviour.

[1] Gorfman, S., Schmidt, O., Tsirelson, V., Ziolkowski, M., Pietsch, U. *Z Anorg Allg Chem*, 639(11), 1953, 2013., [2] Gorfman, S. *Crystallography Reviews*, submitted, 2014.



Keywords: time-resolved X-ray diffraction, external electric effect, ferroelectric single crystals