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Domain kinetics in [001] -poled PMN-39PT single crystal during polarization reversal

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Relaxor-based ferroelectric lead magnesium niobate-lead titanate (PMN-PT) is of high scientific interest due to their outstanding piezoelectric properties. However, there is an information vacuum surrounding the domain kinetics and domain structure evolution. These aspects of investigation are of great importance for development of domain engineering in such crystals.

Here we present the results of domain kinetics study during polarization switching in tetragonal PMN-PT single crystals in clamped area by direct optical observation accompanied by analysis of the switching current. Complementary analysis of current and obtained optical images allowed to reveal the main parameters of switching. We found three types of processes through which the switching took place: a) formation and growth of macroscopic *a*-domains; b) formation of charged domain structures due to intersections of macroscopic *a*-domains; c) formation and growth of *c*-domains. The estimation of optical current showed that the main switching current peak is related to growth of *c*-domains, while the charged domain walls on the intersections of *a*-domains are the reason of the additional small current peak. The two orders of magnitude enhancement of dielectric permittivity was attributed to appearance of such charged domain walls.

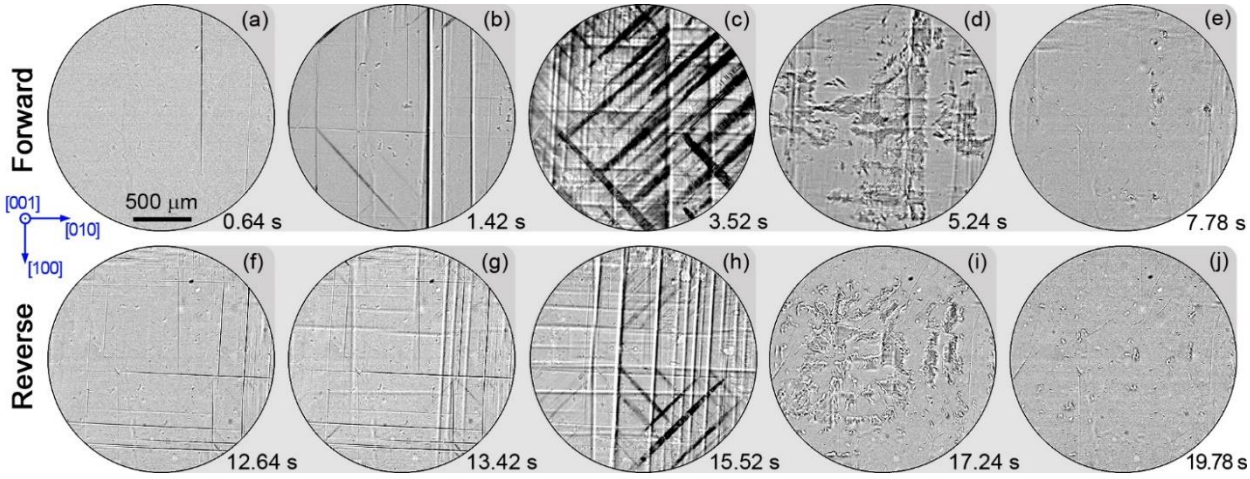

Figure 1. Instantaneous images of domain structure patterns during polarization reversal.

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