Characterization of Profiled LiNbO3 and SBN Crystals by X-ray Diffraction

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The x-ray diffraction experiments were performed on $LiNbO_3$(LN) and $Sr_xBa_{1-x}Nb_2O_6$(SBN) crystals grown by modified Stepanov technique in bulk-profiled configuration using dies of capillary type with different cross-sections. The lattice defects were visualized by x-ray topography. The experiments show the presence in LN samples mosaic blocks drawn out along pulling direction with sizes 5-20 mm in this direction and 0.3-2.0 mm in perpendicular to growth axis. Adjacent blocks were also misoriented with respect to each other with average angles of ~6 arc min. Structure distortions for c-cut of bulk-profiled LN have a character of concentric rings, those form and sizes match to the die construction. The picture of structural imperfections depends on growth conditions forming of crystal-melt interface. For profiled LN grown in high temperature gradients the phase interface was inhomogeneous: flat over die plates, concave to the capillaries. The position of rocking curve maximum depends on x-ray incident angle and displaces together linear scanning along LN sample surface. It indicates the presence of crystallographic plane bend of 0.6+-0.1 degree. Low thermal conductivity of SBN crystals leads to formation of convex to the crystal crystallization front what allows to eliminate such lattice defects as small angle grain boundaries and as a result to obtain crystals of high optical quality. Atomic structure of SBN (x=0.33; 0.61;0.75) was investigated. Peculiarities of distribution of Sr and Ba ions as well as Ce, Tm doping ions in lattice channels are determined.

Keywords: Stepanov technique, x-ray topography, crystal defects