Planar Microdomain Patterns for Nonlinear-Optical Applications Fabricated in Ferroelectric Crystals by Microscopic Methods (AFM and SEM)

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1D and 2D microdomain patterns of specified design have attracted increased attention in view of their applicability for nonlinear-optical frequency conversion. We summarize our results on recording planar microdomain patterns by means of the AFM method and electron-beam of SEM. Experiments were performed in $Sr_xBa_{1-x}Nb_2O_6$ (SBN) and $LiNbO_3$ crystals and He-implanted planar optical waveguides.

In the AFM method, the local polarization reversal occurs under standard AFM dc-voltages applied to the tip. In SEM method it is caused by space-charge fields induced by local e-beam irradiation. We investigated the regularities and specificity of the domain formation under these conditions. Shaping of domain gratings and other 2D patterns with specified parameters was elaborated. Stable domain gratings with spatial periods 3 - 7 μm, several microns in thickness and dimensions up to 500 x 300 μm^2 were recorded. The recorded patterns were examined using the nonlinear-optical methods such as SHG microscopy and nonlinear diffraction.

The results obtained are promising for development of the domain engineering by microscopic methods, in particular in optical waveguides.

References

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