Formation of domain configurations of doped layered TGS ferroelectric crystals

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It is possible in principle to obtain regular domain structures in any ferroelectrics, since polydomain structure is more advantageous. But actually ferroelectric superlattices with a regular domain structure, which find practical application in nonlinear optics, are obtained only on high-temperature crystals of lithium niobate and tantalate. In this regard, the creation of a regular domain laminar structure with 180-degree domains on ferroelectric crystals grown from solutions is of scientific and practical interest. Such crystals can serve both as model objects for fundamental research and as functional material for practical implementation.

The aim of the work was to obtain layered ferroelectric triglycine sulfate single crystals doped with chromium (TGS-TGS+Cr) and to study the profile distribution of chromium impurities over the volume of crystals.

The object of the study was triglycine sulfate (TGS) ferroelectric crystals with a periodic profile distribution of chromium ion impurities (TGS - TGS+Cr). Optical and X-ray topographic microscopy (RT) was used to visualize the impurity structure and evaluate its parameters. The spatial distribution of the impurity was studied by X-ray fluorescence analysis (XRF) and was performed at the Institute of Crystallography. A.V. Shubnikov Federal Research Center "Crystallography and Photonics" RAS.

It was found in the work [1] that in places where the concentration gradient changes sign, domain walls are formed, and where the gradient begins to increase, negative domains are formed, and at a negative gradient, positive domains are formed. In addition, the structure of domain walls is different - there is an alternation of smooth walls and with a rugged structure. A sharp minimum of the impurity concentration corresponded to a smooth wall, and an extended maximum corresponded to a rugged, loose one.

Similar results were also obtained for TGS - TGS+Cr crystals. The work reveals a correlation between the formation of a regular domain structure and the nature of the impurity distribution for layered TGS-TGS+Cr crystals. The formation of domain walls occurs mainly in areas corresponding to a change in the impurity concentration gradient, and in places where the sign changes from positive to negative, smooth walls are formed, and from negative to positive, the domain boundary has a jagged, uneven contour. The mechanism of this phenomenon is not fully understood.

Therefore, in the future, it is planned to carry out a practical study and theoretical calculations on the influence of the impurity gradient on the formation of a domain structure and develop recommendations for obtaining regular 180 - degree domain structure in ferroelectric crystals grown from solutions.

[1]. Duan F.[и др.]. Ferroelectrics. V. 9, (1989).P.91.