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Development of New Approaches to Increase the Intensity of X-ray Radiation in a Pyroelectric Source

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Pyroelectric materials (for example, single crystals of lithium niobate and lithium tantalate or PZT ceramics) are used to generate high potential in vacuum, to accelerate electrons and positive ions, to produce X-rays and neutrons [1-4]. Portable X-ray and neutron sources are being developed, based on this phenomenon [5,6]. However, low intensity makes it difficult to use such sources for practical applications. Recently, various ways of improving pyroelectric sources (application of nanostructures, selection of the optimum rate of temperature change) have been discussed [7-9].

In this report, features and nature of charge generation on the side surfaces (parallel to the axis of spontaneous polarization) of a lithium niobate crystal are considered. It is shown that a large amount of charge on side surfaces is present that affects the process of an electric field generation. Advantages and disadvantages of this effect are considered and demonstrated in light of improving the pyroelectric sources.

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