

# Particle generation using the pyroelectric and piezoelectric effect in lithium niobate and lithium tantalate

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Single crystals of lithium niobate (LiNbO<sub>3</sub>) and lithium tantalate (LiTaO<sub>3</sub>) can be used to accelerate electrons and positive ions to energies of the order of 100 keV and generate X-rays and fast neutrons, as well as to control beams of charged particles. However, this way of particles acceleration and generation does not become widely used yet due to the instability of generated particle flux because of electric breakdowns, crystal impurities, which leads to temporary discontinuation of pyroelectric current.

The sinusoidal mode of changing the temperature of a single crystal makes it possible to observe stable oscillations of the pyroelectric current on the polar surface with typical frequency is order of 1-50 mHz and amplitude of current is about 1-10 nA for samples with area of several cm<sup>2</sup>. In vacuum condition it leads to generation high electric field, which oscillated with the same frequency. Estimated amplitude of electric field is order of 10<sup>5</sup> V/cm. Another way to particle generation is using of mechanical stress on these materials, i.e. initiation of piezoelectric effect.

The possibilities of using such mode of temperature change to obtain a quasi-stable X-ray and electron source are considered. The further prospects for the application of thermoelectric oscillations in the physics of accelerators and charged particles and some features of oscillations are also discussed.

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