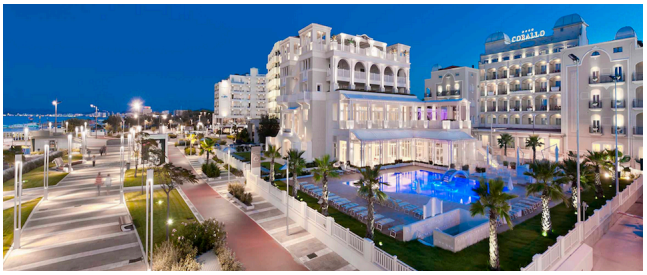

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Stability of electrons and X-rays generated in a pyroelectric accelerator

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Changing the temperature of single crystal lithium tantalate (LiTaO3) at moderate vacuum conditions gives an attractive possibility to generate and accelerate electron up to 100 keV. The electrons are ejected either from the crystal or from the target (depending on polarity). The electrons than generate X-Rays via bremsstrahlung and characteristic X-ray emission processes.

Amptek, Inc (USA) has developed a miniature pyroelectric X-ray source (Amptek COOL-X). However, unstable X-ray emission, lack of reproducibility of the X-ray spectra limits the use of pyroelectric sources for practical applications. The aim of this experimental investigation is the interesting feature of the pyroelectric accelerator to generate a monoenergetic electron flux with a stable value of peak energy for a long time. The reason for such long-term stabilization of flux energy is not clear yet. Here we present studies of features of electron flux in pyroelectric accelerator depending on the pressure of residual gas, the distance between the crystal and the target-collimator. The correlation between monoenergetic electron production and avalanche discharge is discussed. Moreover, a pyroelectric accelerator consisting of a pair of crystals is proposed. The temperature of the crystals was changed simultaneously in opposite polarity to create higher electric field between the crystals and the target to generate high-energy x-rays than could be produced with a conventional single-crystal source.

The pyroelectric x-ray generator technology is currently being developed in a reliable compact, stable, and reproducible x-ray source with controllable parameters, which does not require a high-power DC voltage or the use of hazardous (radioactive) materials.

Primary author: ALI, Majid

Co-authors: KUBANKIN, Alexander; SHCHAGIN, Alexander; OLEINIK, Andrey; KARATAEV, Pavel

Presenter: ALI, Majid

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