Contribution ID: **1544** Contribution code: **TUPA135** Type: **Poster Presentation**

Novel source of electrons in a pyroelectric accelerator

Tuesday, 9 May 2023 16:30 (2 hours)

Development of advanced intense and reliable sources of charged particle beams is a direction within accelerator physics on its own right. By changing the temperature of Lithium Tantalate (LiTaO3) single crystal at moderate vacuum conditions leads to generation of strong electric field. The uncompensated polarization during the heating or cooling of the crystal causes the ejection of electrons from the dielectric layer on the surface of the crystal. The electrons ejected either from the crystal or from the target (depending on polarity) are accelerated and gain energy of up to a 100 keV. The energy of these electrons can be determined by measuring the energy spectrum of the X rays that resulted from the electron interactions with the target. The conception of a pyroelectric accelerator enabled us to develop compact (portable) electron source, which does not require an external high-voltage and the use of hazardous materials.
It is experimentally confirmed that a crystal installed in a chamber with a residual gas pressure of about 2 mTorr could be used to generate electrons with energy of up to 35 keV. The correlation between monoenergetic electron production and avalanche discharge is discussed. By using double crystal, the combined fields of two polarized crystals will enable us to double the acceleration potential.

Funding Agency

Footnotes

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Yes

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Session Classification: Tuesday Poster Session

Track Classification: MC3: Novel Particle Sources and Acceleration Techniques: MC3.T02: Electron Sources