Contribution ID: **56** Type: **poster**

Identification of material by X-ray fluorescence analysis with a pyroelectric X-ray generator

Tuesday, 10 September 2024 18:35 (1 hour)

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.

Here we present studies of features of electron flux in pyroelectric accelerator depending on the Influence of temperature variation. It is revealed that employing only the electron beam enables the successful acquisition of quantitative information regarding the sample content through pyroelectric driven PD-PIXE analysis. These findings set the stage for the development of a compact and versatile apparatus for elemental analysis of materials based on the pyroelectric source.

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Session Classification: Poster session 2