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A Study of Temperature and Electric Potential Distribution in a Novel Pyroelectric Neutron Generator

Pyroelectric neutron generator is an ideal neutron calibration source for free of radioactive contamination and high-frequency noise interference. The basic principle involves using pyroelectric crystals to generate high-voltage electric fields, which in turn accelerate deuterons produced by ionization to bombard deuterium-rich targets, initiating deuterium-deuterium (D-D) nuclear reactions to generate neutrons. Existing pyroelectric neutron generators utilize field emission ionization to produce deuterons, which limits the beam current and acceleration voltage, thereby limiting the neutron yield.

A novel pyroelectric neutron generator that uses a pulsed 1064 nm laser to irradiate the LiTaO3-Mo-TiDx substrate simultaneously for heating and ionization was introduced. This paper discusses the temperature change range and rate of the LiTaO3 single crystal pyroelectric material under laser irradiation, as well as the pulse energy, repetition frequency, loading time, and spot size. In parallel, numerical simulations of the surface charge, potential, and acceleration gap electric field distribution of the LiTaO3-Mo-TiDx substrate have been conducted based on the single-crystal system theory model and the finite element method. The relationship between temperature change and maximum potential and acceleration gap electric field distributions has been established. The main factors affecting the maximum potential and electric field distribution are also analyzed.

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Yes

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