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Design and simulation of a 500 kV acceleration tube for Dynamitron accelerators

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Abstract

Due to their high efficiency and low cost, electrostatic electron accelerators with a moderate energy, are used in the industry. In an electrostatic accelerator, the acceleration tube plays the role of dividing the potential of the high-voltage terminal so that it accelerates the beam incrementally in a straight line. In this paper, an acceleration tube for a Dynamitron accelerator with a voltage of 500 kV is designed by CST Studio Suite software. In this design, an electron gun with flat cathode, and a current of 50 mA was used. In order to extract the beam from the electron gun, two filters are used: electrodes and the lens electrode, with voltages of 495 and 481 kV, respectively; besides for electron acceleration, 13 electrodes with a potential step of 37 kV have been designed. To hold the electrodes and prevent electrical discharges between the electrodes, insulating sheets made of Pyrex are used. At the end of the acceleration tube, a 50mA beam current, a waist radius of less than 0.5 mm, a 73nm radian emittance, and a 0.15μperv beam were obtained. The dimensions of the acceleration tube and the results of investigating the change in the radius of the electrodes, the displacement and deviation of the angles of the first electrode relative to the axis of the acceleration tube are presented in this paper.

Keywords: electrostatic accelerator, acceleration tube, electrode radius change, CST Studio Suite software

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