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CNT-BASED FIELD EMISSION X-RAY SOURCE

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Carbon nanotubes (CNT) emitter has widely become an attractive mechanism that draws growing interests for cold cathode field emission. CNT yarns have demonstrated its potential as excellent field emitters. It was demonstrated that a small focal spot size was achieved by manipulating some electrical parameters, such as applied bias voltage at the mesh gate, and electrostatic focal lenses, geometrical parameters, such as axial distances of the anode, and the electrostatic focal lens from the cathode assembly, and the dimension of the opening of the electrostatic lens. Electrical-optics software was used to systematically investigate the behavior of the electron beam trajectory when the aforementioned variables were manipulated. The results of the experiment agree with the theoretical simulation results. Each variable has an individual effect on the electron beam focal spot size impinging on the target anode. An optimum condition of the parameters was obtained producing good quality of X-ray images. Also, MWCNT yarn was investigated for field emission characteristics and its contribution in the X-ray generation. The dry spinning method was used to fabricate MWCNT yarn from super MWCNTs, which was fabricated by MW-PECVD. The MWCNT yarn has a significant field emission capability in both diode and the triode X-ray generation structure compared to a MWCNT. The low-voltage-field emission of the MWCNT yarn can be attributed to the field enhancing effect of the yarn due to its shape and the contribution of the high-aspect-ratio nanotubes that protrude from the sides of the yarn. Observations of the use of filters on the development of X-ray images were also demonstrated. The amount of exposure time of the samples to the X-ray was also manipulated. The MWCNT yarn can be a good candidate for use in the low voltage field emission application of X-ray imaging.

Keywords: MWCNT, CNT-yarn field emitter, X-ray generation