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Condition of Carbon Fiber Field Emitter Under Different DC Voltages¹ WILKIN TANG, DON SHIFFLER, SUSAN HEIDGER, SABRINA MAESTAS, Air Force Research Lab, MATTHEW LACOUR, KEN GOLBY, SAIC — Field emission cold cathodes have the potential to provide high current density and low voltage operation for THz sources, high power microwave tubes etc. Each of these applications requires the cathode to exhibit long lifetime in the presence of deleterious condition. One type of cathode that is suitable is the carbon fiber field emitter (CFFE). CFFEs are robust and the current emission can easily be modified by surface treatment. The emission property of the CFFE depends critically on the condition of the cathode. Unfortunately, the morphology of the CFFE under different voltage is often unknown. Here, we describe results of a comprehensive experiment that aims to investigate the changes that occur to the CFFE during different DC voltages. SEM images of the CFFE are taken at a 1kV interval (up to 8kV), pre shot SEM images of the cathode are taken for reference. The amount of current produced for each interval is recorded. The evolution of the surface morphology, evidence of resistive heating and height of the CFFE for different voltages are obtained. Their effects on the electron emission are analyzed. A resistive heating model and Particle-in-cell simulations are performed to compare with the experiment.

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