Thermionic properties of carbon based nanomaterials produced by microhollow cathode PECVD

John R. Haase[1], Jason J. Wolinsky[2], Paul S. Bailey[2], Jeffrey A. George[2], David B. Go[1]

[1]*University of Notre Dame, Notre Dame, IN 46556, USA*

[2]*NASA Lyndon B. Johnson Space Center, Houston, TX, 77058, USA*

Thermionic emission is the process in which materials at sufficiently high temperature spontaneously emit electrons. This process occurs when electrons in a material gain sufficient thermal energy from heating to overcome the material's potential barrier, referred to as the work function. For most bulk materials very high temperatures (>1500 K) are needed to produce appreciable emission. Carbon-based nanomaterials have shown significant promise as emission materials because of their low work functions, nanoscale geometry, and negative electron affinity. One method of producing these materials is through the process known as microhollow cathode PECVD. In a microhollow cathode plasma, high energy electrons oscillate at very high energies through the Pendel effect. These high energy electrons create numerous radical species and the technique has been shown to be an effective method of growing carbon based nanomaterials. In this work, we explore the thermionic emission properties of carbon based nanomaterials produced by microhollow cathode PECVD under a variety of synthesis conditions. Initial studies demonstrate measureable current at low temperatures (~800 K) and work functions (~3.3 eV) for these materials.