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Emissive probe sheath effects: Experimental investigation of virtual cathode and charge exchange effect on emissive probes and hot cathode electron sources[1] CHI-SHUNG YIP, Institute of Plasma Physics Chinese Academy of Sciences: Hefei, Anhui, CN, NOAH HERSHKOWITZ, Dept. of Engineering-Physics, University of Wisconsin-Madison — Current-Voltage (I-V) characteristics of strongly emitting emissive probes are investigated in a multi-dipole filament discharge in argon. It is found that at sufficiently high neutral pressure and emission current, the variation of the I-V traces and their associated inflection points no longer follow the previous predictions of space charge limited (SCL) models. A new, steep slope region of the I-V trace appears near the plasma potential when the probe is strongly emitting, causing the inflection point and the floating potential to increase toward the plasma potential as the emission current increases, rather than staying constant. It is also found that the double inflection point structure when the probe is biased below the ionization energy of the working gas is highly likely to be an emission retardation effect from enhanced virtual cathode formation due to the increased local electron density. The dip between the virtual cathode and the bulk plasma potential also increases. This suggests effects predicted by Campanell et al's inverse sheath theory are applicable to a region of emissive probe I-V traces. Mechanisms with which virtual cathode effects limit hot cathode electron emission at high heating power are also investigated.

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