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Study of the effect of pressure on thermionic emission current JOHN HAASE, DAVID GO, University of Notre Dame — Thermionic emission is the process in which heating a cathode allows electrons to gain sufficient energy to overcome the material's work function and be ejected into vacuum. By collecting the emitted electrons at a lower temperature anode and passing them through a load, the thermal energy is directly converted into electrical energy in a process called thermionic energy conversion (TEC). Operating a plasma in the interstitial gap between the cathode and anode produces positive space charge to offset the negative electrons and can improve TEC performance. However, this necessarily requires that the TEC device operates at pressures higher than vacuum. The introduction of a gas between the electrodes of a TEC device can either attenuate, due to elastic collisions, or increase, due to ionization, the current, and this is a strong function of the driving potential from the cathode to anode. In this work, the collected current from thermionic emission in noble gases is examined over a range of pressures and potentials, both experimentally and using kinetic particle-in-cell/Monte Carlo collision (PIC/MCC) simulations. Initial theoretical, simulation, and experimental results show that for electrons with energies below the ionization energy the current i scales with pressure p as $i \propto p^{-n}$, where $\frac{1}{2} \leq n \leq 1$.

John Haase
University of Notre Dame

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