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Study of effective secondary electron emission in dc breakdown of argon with various metal electrodes STEVEN ADAMS, XUHAI HUANG, KENNETH HOWE, VLADIMIR DEMIDOV, Air Force Research Laboratory, Wright-Patterson, Ohio, BOYD TOLSON, UES Inc. — An attractive aspect of Townsend's expression for the ionization coefficient, $\alpha = A \exp[-B/(E/p)]$, is that the exponential form allows a derivation of a neat analytical expression for the Paschen curve. Notwithstanding the elegance and fame of this expression, the theoretical Paschen curve does not always provide an accurate prediction for all E/p ranges and all gases. Deviations can be attributed to a variety of factors, including non-exponential behavior of α at higher E/p, variations of γ with E/p and geometric effects. An experimental study of the effective secondary electron emission in Townsend breakdown has been conducted in Ar using a variety of electrodes. The threshold breakdown voltage was measured when the current became self-sustained, which corresponded to an effective secondary emission coefficient of $\gamma = 1/[\exp((\alpha/p)pd)-1]$. This allowed a fundamental relationship to be derived between γ and E/p from an experimental Paschen curve. In this work, argon gas was studied with copper, aluminum and platinum electrodes. The trends of the effective secondary electron emission are analyzed in different E/p ranges for various modes of secondary electron emission, including Ar ion impact, photon absorption, Ar metastable collisions and heavy-particle-ionization.

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