Abstract

The electron energy distribution function has been measured in the positive column of a nitrogen glow discharge by means of a novel electronic method previously suggested by Boyd, and consideration has been given to the accuracy to which the function was determined.

As in previous determinations, the distribution function in nitrogen was found to consist of two groups of electrons, the mean energies of which were separated by a number of electron volts, and the empirical equation suggested by Swift to describe the low energy group was verified. The increased accuracy of the present measurements enabled the fitting of an empirical equation to the high energy group as well, and it was found that the group could, in all cases, be described by the equation

$$f(V) = C\,(V-V_o)^4 \exp.\ -10.5\,\left(\frac{V-V_o}{\bar{V}_2-V_o}\right)^{\frac{1}{2}}$$

where V_o is a constant energy found in practice to be 5 electron volts and $\bar{V}_2$ is the mean energy of the group.

The nature and mechanism of production of the high energy group was considered on the basis of three models. Two of these were previously suggested models of an electron beam moving along the discharge from the cathode, and the effect of some interaction between moving striations and the plasma. The moving striation model was formulated and a third model, based on superelastic collision with metastable molecules,

was introduced.

It was shown that the electron beam model was unable to explain the results obtained and this model was rejected. Suggestions are put forward for discriminating between the moving striation and the metastable models.