

MEASUREMENTS OF SPACE CHARGE DENSITY PRODUCED BY AN ENVIRONMENTAL IONIZER

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An environmental ionizer is a device widely used to produce ionization in the ambient air and to reduce contamination levels in clean rooms. In the present work the corona discharge produced by a commercial ionizer consisting of a pair of point electrodes, both at a negative voltage of -6 kV, is characterized to estimate the space charge density in the air at various distances from the ionizer.

The measurements were made by using the principle of biased probe originally described by Tassicker [1]. The probe system consists of a circular plane probe of radius r_p , located coplanarly and coaxially within a circular ring of radius r_a so that an annular gap of width $g = r_a - r_p$ is thus formed. A bias voltage is applied between the two parts to control the conduction current to the probe. From the current-voltage characteristic of the probe the magnitude of the external electric field at the probe surface can be deduced. The estimation of the space charge density can be made from the combined current density and field data, assuming the mobility of the charge carriers is known. The applicability of this probe technique was demonstrated by Selim and Waters [2].

We have obtained values of negatively charged particles density varying from $12 \times 10^{13} \text{ m}^{-3}$ at a distance of 3.5 cm from the ionizer (in the central axis between the twin-point electrodes) to $0.6 \times 10^{13} \text{ m}^{-3}$ at a distance of 30 cm. Additional analysis in a point-plane corona in air was also performed and comparisons are made with previous work. The results have shown that the biased probe is a valuable diagnostic tool to determine the properties of discharges in air such as those produced by environmental ionizers.

[1] O. J. Tassicker, *Proc. IRE* 121, 213-220 (1974).

[2] E. O. Selim and R. T. Waters, *IEE Trans. IA-16*, 458-463 (1980).