BREAKDOWN IN NON-UNIFORM FIELDS

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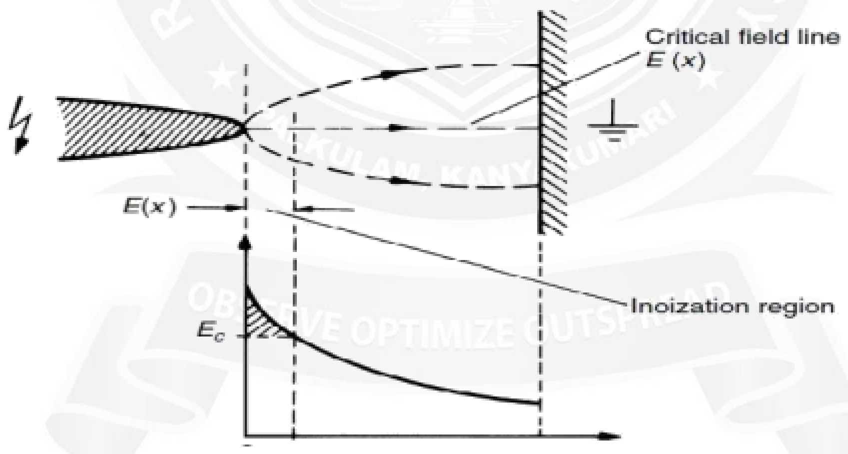

Figure 1.4.1 Breakdown in Non uniform Fields

[Source: "High Voltage Engineering" by C.L. Wadhwa , Page – 199]

The expression is valid also for higher pressures if the field is only slightly non- uniform. In strongly divergent fields there will be at first a region of high values of E/p over which $\alpha/p > 0$. When the field falls below a given strength E_c the integral

$$\int \overline{\alpha}\, dx$$

Townsend mechanism then loses its validity when the criterion relies solely on the γ effect, especially when the field strength at the cathode is low.

In reality breakdown (or inception of discharge) is still possible if one takes into account photo ionization processes. The criterion condition for breakdown (or inception of discharge) for the general case may be represented to take into account the non-uniform distribution of

$\overline{\alpha}$ or

$$exp \int_0^{x_{c<d}} \overline{\alpha} dx = N_{cr}$$

where N_{cr} is the critical electron concentration in an avalanche giving rise to initiation of a streamer (it was shown to be approx. 10^8), x_c is the path of avalanche to reach this size and d the gap length.

$$\int_0^{x_c<d} \overline{\alpha} dx = ln\, N_{cr} \approx 18 - 20 \qquad 2.15$$

Figure 2.9 illustrates the case of a strongly divergent field in a positive point plane gap. Equation (2.15) is applicable to the calculation of breakdown or discharge inception voltage, depending on whether direct breakdown occurs or only corona.