TUTORIAL 2

EE 475 TUTORIAL

1. Gas constants for a certain gas insulant are given as A = 15 $cm^{-1}\,torr^{-1}$ and B = 365 $V\,cm^{-1}\,torr^{-1}$. A uniform field gap will be insulated with this insulant at a pressure of p = 1000 torrs. At a gap setting of d = 3.2 cm the observed breakdown voltage is 128 KV .
   a) find α
   b) find γ
   c) If $I_0 = 5.10^{-13}$ and d= 1.5 cm , using the α and γ calculated find the ionization growth current.

Solution:

a)

$$\alpha = Ape^{-\frac{Bp}{E}}, E = \frac{V_S}{d}$$

$$\alpha = Ape^{-\frac{Bpd}{V_S}} = (15)(1000)e^{-\frac{(365)(1000)(3.2)}{128000}} = 1.6336\ cm^{-1}$$

b)

$$\alpha d = \ln\left(\frac{1}{\gamma} + 1\right) \Rightarrow Breakdown\ criterian$$

$$(1.6336\ )(3.2) = \ln\left(\frac{1}{\gamma} + 1\right)$$

$$\frac{1}{\gamma} = e^{(1.6336\ )(3.2)} - 1 = 185.33$$

$$\gamma = 5.3957 * 10^{-3}$$

c)

$$I = \frac{I_0 e^{\alpha d}}{1 - \gamma(e^{\alpha d} - 1)}$$

$$I = \frac{(5.10^{-13})e^{(1.6336)(1.5)}}{1 - (5.3957 * 10^{-3})(e^{(1.6336)(1.5)} - 1)}$$

$$I = \frac{5.7964 * 10^{-12}}{1 - (5.3957 * 10^{-3})(11.5929 - 1)} = \frac{5.7964 * 10^{-12}}{0.9428}$$

$$I = 6.148 * 10^{-12}\ A$$