



- 1- What are the physical conditions governing ionization mechanism in gases dielectrics?
- 2- Based on Townsend Criteria for Breakdown in non-electronegative gaseous insulation
 - Give the meaning of Spark voltage and Sparking distance
 - Derive a relation between Spark voltage and Sparking distance
 - Explain why electronegative gases has high Breakdown value

Model Answer

- 1- What are the physical conditions governing ionization mechanism in gases dielectrics?
 - 1) Pressure
 - 2) Temperature
 - 3) Electrode configuration
 - 4) Nature of electrode surface
 - 5) Availability of initial conducting particles

- 2- Based on Townsend Criteria for Breakdown in non-electronegative gaseous insulation
 - Give the meaning of Spark voltage and Sparking distance

We have Town-sends criterion for BD $(\gamma e^{\alpha d} = 1)$

The voltage applied which creates the above breakdown condition is called spark voltage V_s and the corresponding gap d is called sparking distance.

- Derive a relation between Spark voltage and Sparking distance

Town-sends current growth equation is

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

Town-sends criterion for BD

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

Since $e^{\alpha d} \gg 1$

The criterion becomes

$$\gamma e^{\alpha d} = 1$$

Where γ = Town-sends secondary ionization coefficient

α = Town-sends primary ionization coefficient

d = gap

Sparking distance $d = [\ln (1/ \gamma)] / \alpha$

Spark voltage $V = E d$

- **Explain why electronegative gases has high Breakdown value**
 - The molecules of (SF₆ gas) electronegative gases have the property of electron attachment, (i.e., the outermost orbit of the molecules has holes)
 - These molecules attach the electrons in the gap to become negative ions
 - Negative ions have lesser mobility than electron
 - This attachment plays an effective role of removing electrons which otherwise have led to current growth and break down
 - Number of attaching electrons made by one electron drifting 1 cm in the direction of the field is called attachment coefficient.