Dielectric strength :- " The voltage per unit thickness that can be substained by an insulating material befor it's breakdown is called as dielectric strength. A good dielectric material has high dielectric strength."

The dielectric breakdown occures on account of the following factors. Dielectric strength depends on the thickness of the dielectric material and on the duration of time for which dielectric subjected to electric field.

1. Intrinsic or Zener breakdown
2. Thermal breakdown. ⟶ occure at High temperature due to poor heat dissipiation
3. Electrochemical breakdown
4. Discharge breakdown.
5. Defect breakdown.

(1) Intrinsic or Zener breakdown occures when electrons in the valence band cross the forbidden gap under the Influence of applied voltage.

(3) Electrochemical breakdown occures when the leakage current increases at High temperature.

(4) Discharge breakdown occure due to the pressence of gas bubbles in the solid and their bombardment when external field is applied.

(5) Defect breakdown occures on the surface of dielectric materials due to Moisture.

Dielectric Loss :- The absorption of electrical energy by a dielectric material subjected to an alternating electric field is known as dielectric Loss. The dielectric Loss caused by an ac field also results in dissipation of the electric energy as heat in the material. An ideal dielectric does not absorb electrical energy. However, a real dielectric always causes some Loss of electrical energy.

Consider an alternating electric field.

$$\vec{E} = E_0 \exp(i\omega t)$$

i = Complex Number.

ω = frequency of Ac field.

Displacement vector $\vec{D}$

$$\vec{D} = \epsilon_0 \vec{E} = \epsilon_0 E_0 \exp(i\omega t)$$

Charging current density.

$$\vec{J} = \frac{\partial \vec{D}}{\partial t}$$

$$= i\omega \epsilon E \exp(i\omega t)$$

$$\vec{J} = \omega \epsilon E \exp\left\{i\left(\omega t + \frac{\pi}{2}\right)\right\}$$

Factors affecting Polarisation:- The polarisation process is affected by following factors

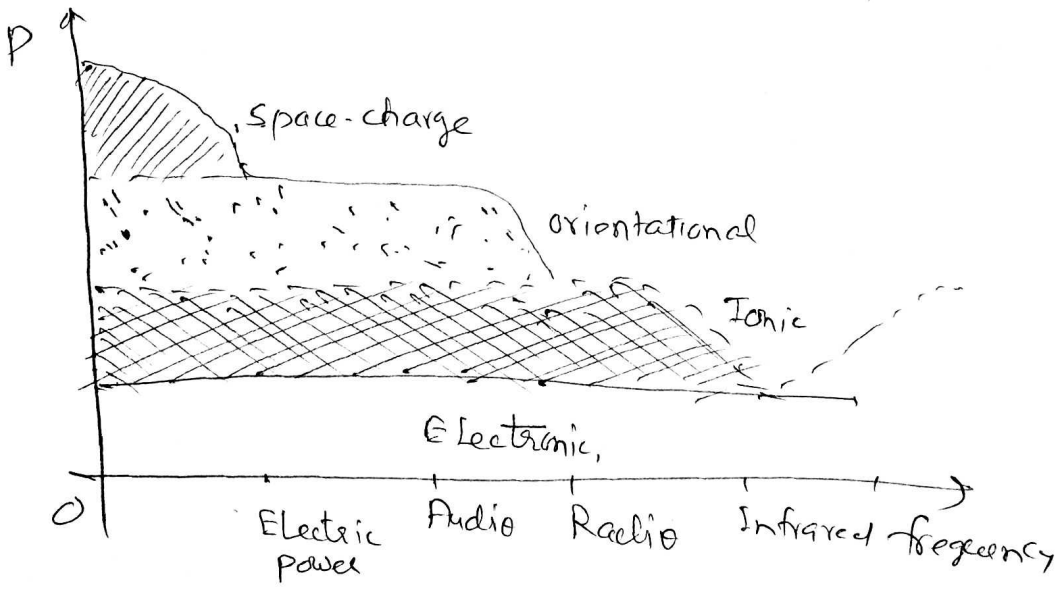
1. Time
2. Frequency of applied field and
3. Temperature.

Suppose a dielectric material is subjected to a static applied electric field for a duration t, then a maximum polarisation P_{max} develops. After relaxation time t_r, the polarisation decreases to P, as given bellow.

$$P = P_{max}\left[1 - e^{-t/t_r}\right]$$

It is due to fact that the atoms and molecules are get disturbed when an electric field is applied to dielectric.

The effect of frequency of applied field can be easily understand by following figure. The Electronic polarisation occurs at all frequencies. The Ionic and Orientational polarisation occurs between Electric Power and Infrared. The slowest process is Space charge polarisation The space-charge polarisation occurs at ordinary frequency



Problem:- The polarizibility of ammonia molecule is found approximately by the measurement of dielectric constant as 2.42×16^{39} C^2m/N and 1.74×10^{-39} cm/H at 309 K & 448 K respectively. Calculate for each temperature the Orientation Polarizability.