

DIELECTRIC BREAK DOWN

A dielectric material is ideally a perfect insulator. They are used in electrical and electronic circuits as insulators and as dielectric medium in capacitors. When a dielectric is subjected to an electric field, there is a limit to the field up to which it acts as a perfect insulator .beyond a certain critical electric field, the dielectric starts to conduct, and it is said to have reached its breakdown electric field .the electric field at which the dielectric breaks down is called its dielectric strength and it is measured in Volts/m. .

There are three breakdown mechanisms in a dielectric:

1. Avalanche break down
2. Thermal breakdown
3. Defect breakdown

Avalanche break down

This can be explained on the basis of band theory of insulators discussed in chapter dielectrics have completely filled valence band and

a wide energy gap ($>5\text{eV}$) between the valence band, and the conduction band .

when a dielectric is subjected to high electric fields the electrons in the valence band acquire sufficient energy to overcome the large energy gap and get excited to the conduction band. The mobile electrons get highly accelerated in the high electric field and so by collisions they excite more electrons to the conduction band .thus more and more electrons are released to the conduction band resulting in an avalanche of conduction electrons .ultimately the material becomes highly conducting and is said to have reached the breakdown field.

Thermal break down

When high frequency ac field is applied to a dielectric there will be energy loss ,as discussed earlier, and this energy has to be dissipated as heat energy .if the dissipation is not effective , due to poor thermal conductivity of the dielectric ,the material gets heated up and may cause melting of the dielectric .this is called thermal break down.

Defect breakdown

This type of break down occurs in dielectric materials in which there

are defects like cracks and pores .gases can collect in the cracks and pores. At high electric field , local electric field at the small cracks and pores will be so high that gas discharge will occur ,causing breakdown of the dielectric.

Source : <http://mediatoget.blogspot.in/2011/08/dielectric-break-down.html>