* Discuss the different band of semi-conductor? 24 with energy gap.

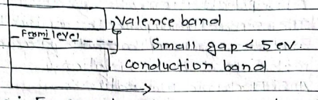


Fig: Energy band of semiconductor.

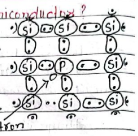
1) Valence band:
↳ In electrical insulators and semiconductors, the valence band is the highest range of electron energies in which electrons are normally present at absolute zero temperature. For example a silicon atom has fourteen (14) electrons.
↳ In the ground state they are arranged in the electronic configuration [Ne] $3s^2 3p^2$. Of these four are valence electrons, occupying the 3s orbital and two of the 3p orbitals.

2) Conduction band
↳ The conduction band is the lowest range of vacant electronies states in electrical insulators and semiconductor.
↳ On a graph of the electronics band structure of material the valence band is located below the fermilevel, while the conduction band above it.

3) Energy gap
↳ The band gap in semiconductor is very low must be approximately 1eV.
↳ The semiconductor acts an insulator at very low temperatures and that gradually begins conducting as the temperature increases.

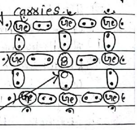
Explain N-type 22 and P-type semiconductor?

Ans: N-type semiconductor.



=> If pentavalent impurity such as phosphorous (P) is added to pure semiconductor sillicon (Si) N-type semiconductor obtained.
=> The fift electron has no chance of forming of covalent bond this electron is loosely bound to the prevent atom and free.
=> Each impurity atom denoted one free electron to conduction band.
=> Due to region pentavalent impurities are also called donar type impurities.
=> In N-type semiconductor electron are majority carries and hole are minority carries.

Ans: P-type semiconductor:



=> If trivalent impurity such as boron (B) is added to pure germinium (Ge) crystal P-type semiconducter is obtained.
=> With four surronding germinium atom one band is left in complete and give rise to hole.
=> In this case three valence electron of carbon atom form covalent bond.
=> Therefore each carbon atom added one hole is created.
=> A small amount of carbon provide million of hole Boron atom accept one electron to complete covalent bond.
=> Due to region trivalent impurities are also called acceptor impurity.
-> In this type hole are majority carries & electrons are minority carries.

Explain iron 20 alloys? 20

a) Ferritic, iron chromium aluminium alloy:
=> These alloys consist of mainly iron, chromium (20-30%) and aluminium (4-7.5%).
-> low cost heating element.
-> High resistivity good thermal conductivity.
-> used in toaster and other small appliances.

b) Iron-nickel-chromium alloys:
-> There are basically two group of alloys: Ni-Cr-Fe alloys with excellent strength at high temperature and the ability to resist oxidation, carburisation and other types of high-temperature corrosion.

c) Ferritic chromium Aluminium alloy:
=> used as heating element in hot plate iron electric farnases.
-> used in heavy realay switches and resistor application.
-> Excellent life time, domestic appliances, heater etc.

Uses of Nickel?
i) Aircraft gas turbines.
ii) medical application.
iii) Neuclear power plant.
iv) chemical and petrochemical industries.
v) make coins.
vi) making wires.
vii) making variou types of alloys.

Explain dielectric 30 material?
=> The materials which do not conduct electricity are called dielectric material.
-> E.g. glass, plastic, mica, nitrogen, dry air, hydrogen transformer oil, silicon fluide. etc.

Explain dielectric constant?
=> The ratio of relative permitivity and permitivity of free space of a substance is called dielectric constant.

Explain dielectric breack-down?
=> Electric or dielectric breack-down is a long reduction in the resistance of an insulator when the voltage applied across it exceeds the breakdown voltage. This result in the insulator becoming electrically conductive.

* Different between dielectric breack down & strength.

Diectric breack down	Strength.
1. Dielectric breack down is the failure of an insulatin material to prevent the flow of current	Dielectric strength is the voltage than an insulating material can withstand before breack down occurs.
2. The value of electrical potential at which this occurs is called breack down voltage. (measured in volt).	2. The dielectric strength is the potential gradient at which this occurs. (expressed in volt per meter)
3. breackdown voltage will be large for thicker material and smaller for thinner material.	3. Dielectric strength remain unchanged.

Explain dielectric 28 breackdown in solid, gas and liquid?

Ans: Dielectric breack down in solid.
i) Thermal breackdown.
ii) Electro-mechanical breackdown.
iii) conductive breackdown.
iv) Intrinsic breackdown.

Thermal breackdown:
=> In heterageneous dielectric the presence of nonuniform (varrying) electric resistance across dielectric could cause uneven leakage current flow through it.
-> In that region when the current intense the resulting would raise the temperature lowering the electrical resistivity. this effect result in thermal breackdown by electric conduction.

Electromechanical breackdown:
=> This refers to mechanical failure in a dielectric due to intensense electrostatic pressure enerted on dielectric.

conductive breackdown:
=> It is caused by ionic charge carries in the dielectric that more in it at electric field itself produced additional ion collision of electrons and molecluse so that current increase with increases in voltage.

Intrinsic breackdown:
=> When voltage are applied only for short duration of other of 10^{-8} second, the dielectric strength of solid increases vary to on upper limit is called intrinsic breackdown of material.

What is polarization 26? Explain electronic and ionic polarization?

Ans: polarization:
=> The separation of center of positive charged and the centre of negative charged in a material called polarization.

Ans: Electronic polarization:
=> Electronic polarization occur due to the displacement of the centre of negatively charge electron relative to positive charge of atoms by electric field:

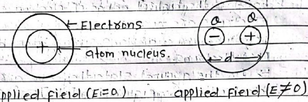


Fig: Electronic polarization.

=> Example of electronic polarization are helium and argon etc. The shifting electron could result in dipole moments and it is defined as the product of and shifting distance.

i.e $p = Qd$. —— (i)

-> The dipole moment 'p' is directly proportional to the electric field 'E'.

i.e $p \propto E$

$p = \alpha_e E$ —— (ii)

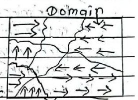
where, α_e = is constant of proportionality and is called coefficient of electronic polarization.
-> The polarization is independed upon temperature.
=> Electronic polarization can be calculate by,

$$\alpha_e = \frac{Ze^2}{m_e W_0^2} \quad [m_e = 9.1 \times 10^{-31} \text{ kg}]$$

where,
Z_e => atomic number. m_e => mass of electron.
W_0 => oscillation frequency of centre of mass of electron.

Explain Domain 36 structure and eddy current loss?

Ans: Domain structure:
=> A magnetic domains is a region whithin a magnetic material which have uniform magnetization.
-> This means that the individual magnetic moments of the atoms are alligned with one another and they point in the same direction.



-> These magnetic domains are responsible for magnetic behaviour of ferromagnetic material.
-> The region separating the magnetic domain are called domain structure. Domain wall.

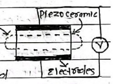
Ans: Eddy current loss:
-> When an alternating magnetic field is applied to the magnetic material the material is subjected to rate of change of flux linkage according to Faraday's law of electromagnetic induction. an emf are induced in the material. Some current will circulate in the core and this circulating current is known as eddy current.
-> This results in the heating up of the material which cause the loss of energ called eddy current loss.
-> In order to reduce eddy current loss in partical application, the core can be made thin sheets laminated which are electrically insulated each other.
-> Eddy current loss is depend on the nature of materials.

Explain ferro-electricity 34 and piezo electricity?

Ans: Ferro electricity:
=> certain crystall like barrium ($BaTiO_3$) which have large permanent polarization even in the absence of electric field are ferroelectricity crystal and this phenomenon is called ferro-electricity.
-> example of ferroelectricity materials are $BaTiO_3$ & $PbTiO_3$ etc.

Ans: properties of ferro electricity.
↳ Extremly high dielectric constant.
↳ spontaneous polarization in the absence applied electric field.
↳ strong non linear dielectric response to an applied electric field.
↳ High strain response to applied electric field.
↳ strong variation in polarization with temperature.

Ans: piezo electricity.



↳ piezo electricity is the electric charged that accumulates in certain solid material in response to applied mechanical stress.
↳ The word piezo electricity means electricity resulting from pressure.

Ans: properties of piezo electricity.
↳ High strain (charge) constants, permitivity.
↳ low mechanical quality factor.
↳ High curie temperature range and thermal stability.
↳ High strain output useful for large displacement at modest voltage.
↳ The d_{33} (dp) values are also estimated by the stress induced charge based on direct piezoelectric effect.

What are insulating 32 material? and it's characteristic
=> Ans: Insulating material:
=> A materials that responds with very high resistance to the follow of electric current is called an insulating material.
-> In insulating materials the valence electrons are tightly bonded to their atoms.
e.g: plastic, porcelain, glass, mica, oil, gases (SF_6).

Ans: characteristic of insulating materials:
i) Large insulating resistance.
ii) small dielectric loss.
iii) low permitivity.
iv) High dielectric strength, mechanical strength & high thermol strength.
v) verry low electrical and thermol conductivity.

uses of insulating materials?
i) High voltage appliances.
ii) circuit boards.
iii) power and electronics system.
iv) cable and transmission lines.
v) Electrical ruber mats.
vi) personal protective equipment.
vii) Domastic portable appliances.

properties of insulating gases?
i) high dielectric strength, High thermal stability.
ii) low toxicity and low bolling point.
iii) good heat transfer properties.
iv) low cost.
v) Non-Flammability.
vi) good dielectric properties.