भारतीय ज्ञान परंपरा में शिक्षा के समाजशास्त्रीय आधार

सम्पादक :
डॉ. दिनेश चन्द्र शर्मा

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Conductor and its Type

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Defination : Some metal show frictionless motion of e above 0^0 k temp. there metal called super conductor and this phenomena known as superconductivity.

* In super conductor zero resistance present so there is no energy loss to carry current.

* The superconductor move (float) above a magnetic field without any support.

Critical temp.(C.T.) : The temp. at which substance show super-conductivity, this temp. know as C.T. (> 4.2k)

Above C.T. (> 4.2K) substance does not show super conductivity.

Common rule for superconductivity :-

1. Ferromagnetic (FeO) and antiferromagnetic (MnO_2) species does not show this phenomena.

2. Only some metal show superconductivity (at 4.2k).

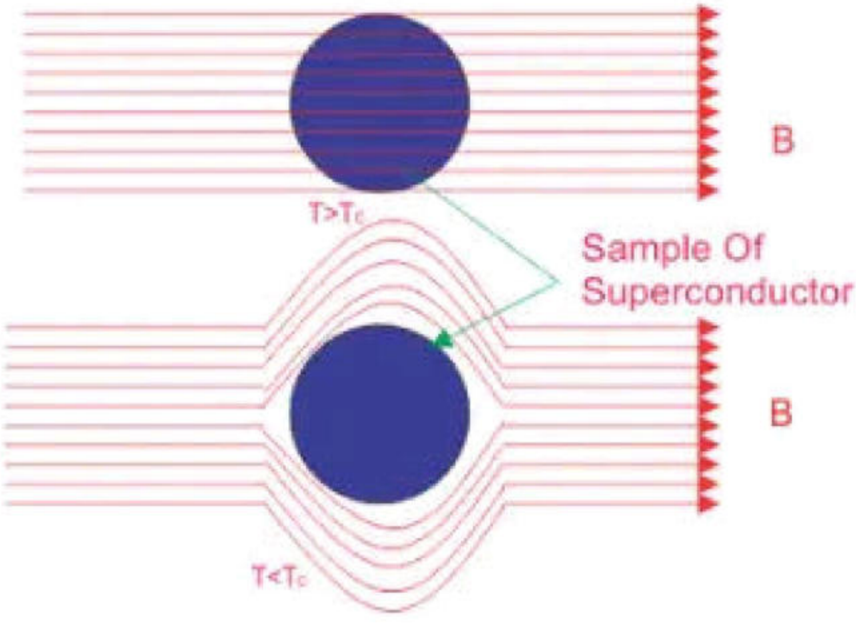
3. Above C.T. the super conductor become poor conductor.

4. Many substance are Superconductor but there constituent metal may be or may be not substance as be not be superconductor. Ex. Au2Bi is superconductor but Au or Bi is not superconductor.

5. Superconductor show perfect or complete diamagnetism..

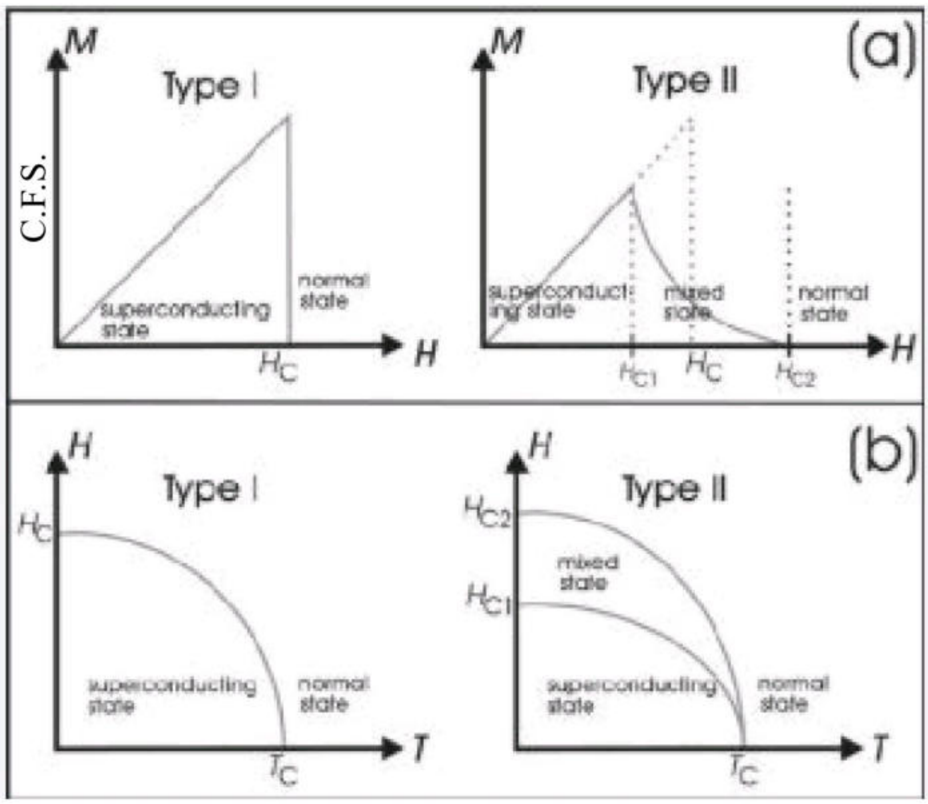
Magnetic property of super conductor :-

Superconductor are complete diamagnetic if magnetic field apply to super conduct then the magnetic flux is excluded & Super Conductor repute the magnate.



If the magnetic field strength increase then critical temp. (C.T.) is drop. The minimum value of this strength which bring about this change (change in C.T.). Known as critical field strength

Critical field strength



Temp.

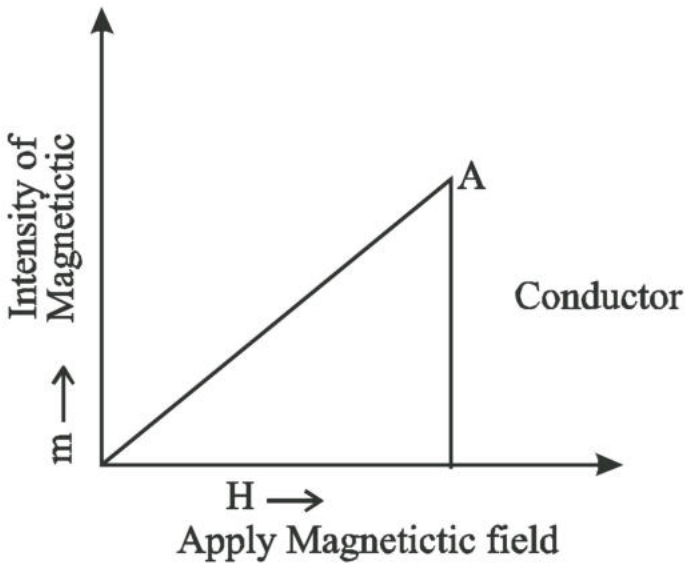
Types of superconductor:-

1. Type - I superconductor :- When this type of super conductor place in external magnetic field then they loss there superconductivity easily at critical magnetic field (HC).

* After HC superconductor become conductor.

* Type-I superconductor also called soft superconductor because they easily loss. their superconductivity

Type-I-superconductor obey meissner effect.



Type I Superconductors

2. Type - II super conductor :- When this type of super conductor place in external magnetic field, it gradually loss their superconductivity.

* They start loss their superconductivity at HC (i) and complete loss at HC (ii)

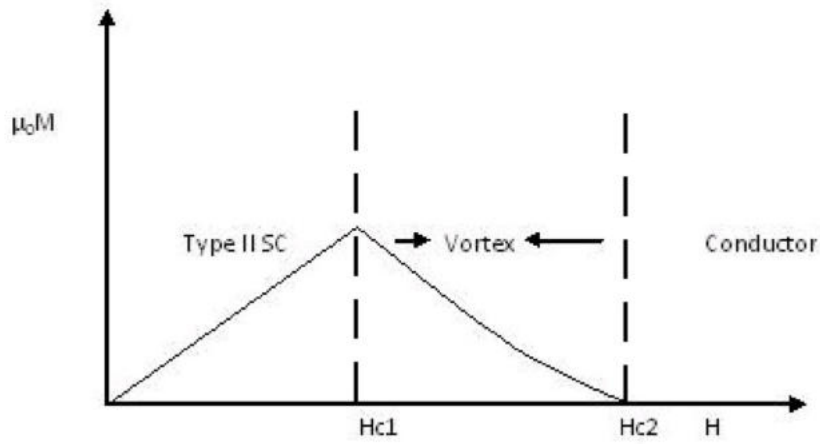
* HC(i) - lower critical magnetictic field.

* HC(ii) - Upper magnetic field..

* The state between HC-I and HC-II is known as vortex stage or intermediate state.

* After HC-II superconductor, become conductor. This type of superconductor is also know as hard super conductor because they loss their superconductivity gradually.

* Type-IInd superconductor obeys Messiner effect but not completely.



Type II Superconductors

Theory of superconductor :

(1) BCS theory : This theory given by Bardeen. cooper and Schrieffer about superconductivity according to this theory electron pair flows without resistance in certain material at low temperature.

* There is indirect interaction (coulomb) between two electron. this interaction is very weak that binds the e^- together and forming cooper pair. This cooper pair is responsible for superconductivity.

* The e-interaction must be strong and low temp. are favour in pair formation.

* Hence at high temp. superconductor are not predicted by BCS theory.

* According to this theory all copper pair are move in a system (Lattice) when external voltage are applied due to this motion current is follow into lattice but when voltage remove then copper pair also move because lattice does not scattered to copper pair so there is no resistance and system become super-conductor..

* If temp. increase of the system then, copper pair e^- are seprated each other. and system become conductor.

* This theory explain (superconductivity of) only type-I super conductor. this theory applicable for those superconductor that have:-

* They show Messther effect:-

* They show isotope effect :-

* The energy gap between two e^- must be 10^{-8} per atom

Note : The copper pair eo follow the law Pauli exclusion law (opposite spin).

Doping (semiconductor) :- In semiconductor production doping is is the intentional introduction of impurities into an intrinsic semiconductor for the purpose of modulating, its electrical optical and structural properties. The doped material is referred to as an extrinsic semiconductor. A semiconductor doped to such high levels that it acts more like a conductor than a semi-conductor is referred to as degenerate semiconductor, in the context of phosphuors and scintillators doping is better known as activation. Doping is also used to control the colour in some pigments.

Techniques of doping and synthesis : The synthesis n-type as semiconductors may involve the use of vapour-phase epitaxy. In vapour-phase epitaxy .A gas containg the negative dopant is passed over the substrate water.in the case at n-type gas doping hydrogen sulphur is passed over the gallium arsenide and sulphur is incorparated corporated into the structure.

Doping in conductive polymers : Conductive polymers can be doped by adding chemical reactants to oxidize or some time reduce the system so that electrons are pushed into the conduction orbitals within the already potentially conduction system.

1.Chemical Doping involves exposing a polymer such as melanin, typically a thin film, to an oxidant such as iodine or bromine alternative the polymer can be exposed to a reductant this method is far less common and typically involves alkali metals .

2.Electrochemical doping involves suspending a polymer-coated, working electrode in an electrolyte solution in which the polymer is insoluble along with separate counter and reference electrodes. an electric potential difference is created between the electrodes that causes a charge and the appropriate counter ion from the electrolyte to enter the polymer in the form of electron addition or remove.

Doping in organic molecular semiconductors : Molecular dopants are preferred in doping molecular semi- conductor due to their compatibilities of processing with the lost that is, similar evaporation temp. or controllable solubility. additionally the relatively large sizes of molecular dopants compared with those of metal ion (such as Li^{+} & MO^{+6}) are generally beneficially.

Magnetic doping : Research or magnetic doping has shown that considerable alteration, of certain properties such as specific heat may be affected by small concentration of an impurity. for example dopant impurity in semiconducting ferro-magnetic alloys is can generate different properties. as first predicted by white Hogan, shul and nakamura. the inclusion of dopant elements to imparts dilute magnetism is of growing significance in the field of magnetic semiconductors.

Modulation doping : Modulation doping is a synthesis technique in which the dopants are spatially separated from the carriers in this way clarrier donnor scattering is suppressed, allowing very. high mobility to be attained.

Magnetic domains : A magnetic domain is a region within a magnetic material in which the magnetization is a uniform direction. this means that the individual magnetic moments of the atoms are aligned with one another and they point in the same direction. When cooled below a temp. Called curie temp., the magnetization of a piece of ferromagnetic materials sportensenly divides into many small regions called magnetic domains. The magnetization of each domain sis a uniform direction, but the magnetization of different domains may point in different directions. magnetic demain str. is responsible for the he magnetic behaviours of ferromagnetic behaviours like iron, nickel, cobalt and their alloys, and ferromagnetic materials like ferrite.

Why domains form : The reason a piece of magnetic material such as Iron spontaneously divides into separate domains, rather then exist in a state with in the same. Magnetization in the same direction through the material is to minimize its internal energy. alarge region of ferromagnetic material with a constant magnetization throughout create a large magnetic field extending into the space outside itself.

Size of domains : As explained above, a domain which is too big is unstable, and will divide into smaller domain. but a small enough domain will be stable and will not split. and this determines the size of the domains created is a material. The size depends on the balance of several energies within the material. Each time a region of magnetization splits. Into two domains, it creates a domain wall - between the domains, where magnetic dipoles with magnetization point different direction are adjacent the exchange interaction which creates the magnetization is a force which tend to align nearly dipoles so they point in the same direction forcing adjacent dipoles to point in different direction requires energy. Therefore domain wall requires extra energy, called the domain wall energy, which is proportional to each time a a the area of the wall.

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