

## Soft Superconductor

### Type I Superconductor

The superconductor in which the magnetic field is totally excluded from the interior of superconductor below a certain magnetising field ( $H_c$ ) and at  $H_c$  the material loses superconductivity and the magnetic field penetrates fully are termed as type I superconductor or soft superconductor.

## Hard Superconductor

### Type II Superconductor:

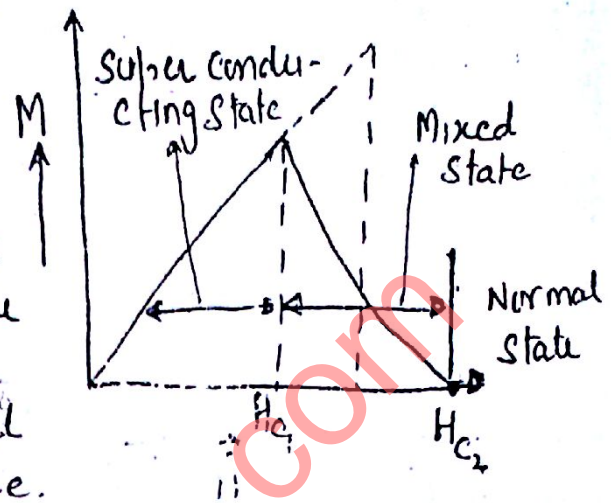
The superconductor in

which the material loses magnetisation

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gradually rather than suddenly are termed as type II super conductor or hard super conductors

Type II Super conductor have two critical field called lower critical field ( $H_{c1}$ ) and upper critical field ( $H_{c2}$ ). Below the critical field  $H_{c1}$  material become super conducting state until the upper upper critical field  $H_{c2}$  is reached at which material return to the conducting state.



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B.C.S Theory:-

In 1957 Bardeen, Cooper and Schrieffer gave a theory to explain the phenomenon of super conductivity. Which is known as BCS theory. The theory is based on the formation of Cooper pairs.

In metal electrical resistance arises due to the collision of conduction electrons with the vibrating ions of the lattice. In normal state the force between the electrons is repulsive. In superconducting state the force between two electrons become attractive due to formation of Cooper pair. This is given as:-

When a current flow through a superconductor, and an electron comes near the positive charge (ion) of the lattice. Then the electron experience an attractive force. Due to interaction between electron and positive ion. Then the positive ion is gets displaced. This is known as lattice distortion and this distortion produce a Phonon (mechanical wave).

Now suppose that another electron comes near the distorted lattice.

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Then the electron interact with the phonon and electron absorb that phonon. In this way two electron interact with each other through the phonon. This process are called electron-phonon-electron interaction. And a pair of (e-p-e) is formed. This pair are called Cooper pair.

The Cooper pair of electron moves on without suffering any deviation. Hence there is no exchange of energy between pair of electron and positive ion. If an electric field is established inside the substance the electron gain additional kinetic energy and gives rise to current. Thus the most important point is that pair of electron does not transfer any energy to the positive ion of lattice. Therefore they do not get slowed down. As a result the substance does not possess any electrical resistivity and the conduction is very large. This process are called super conductivity.