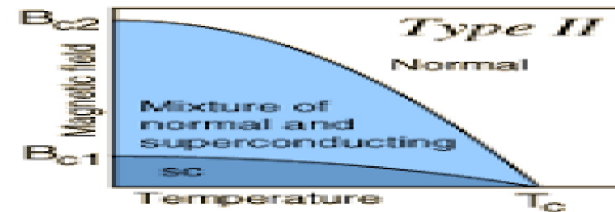
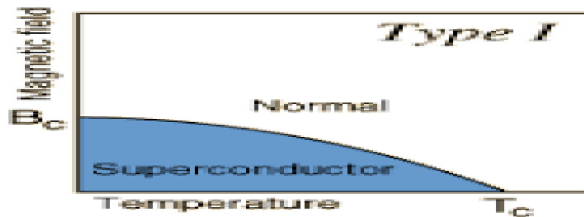


Topic: Types of superconductor



Subject : Physics

Code : 3110018

Prepared By:

Dr. Sonal Mathur

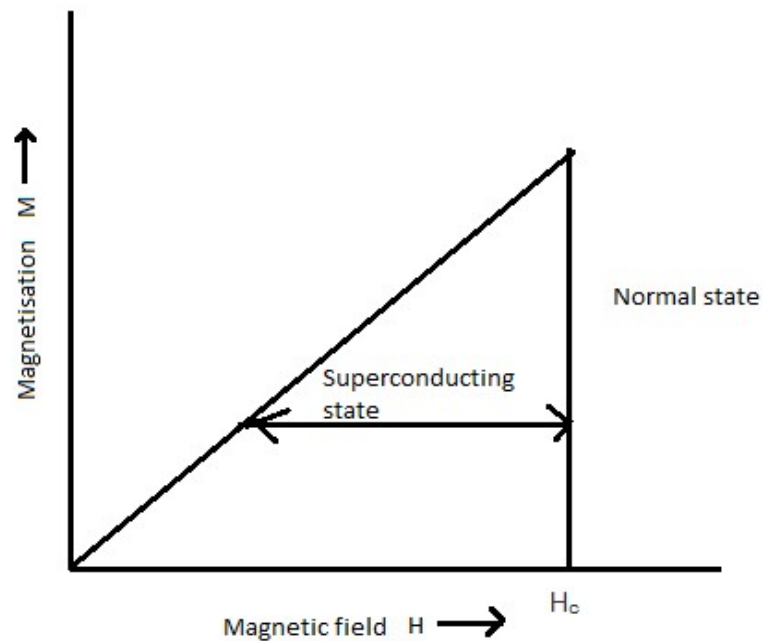
(H&As. Department ACET)

TYPES OF SUPERCONDUCTORS

- Depending upon the behavior in an external magnetic field, superconductors are divided into two categories:
 1. Type-I superconductor or soft superconductor
 2. Type-II superconductor or hard superconductor

Type-I Superconductor

Type-I superconductor acts as a perfect diamagnetic material and obeys Meissner effect

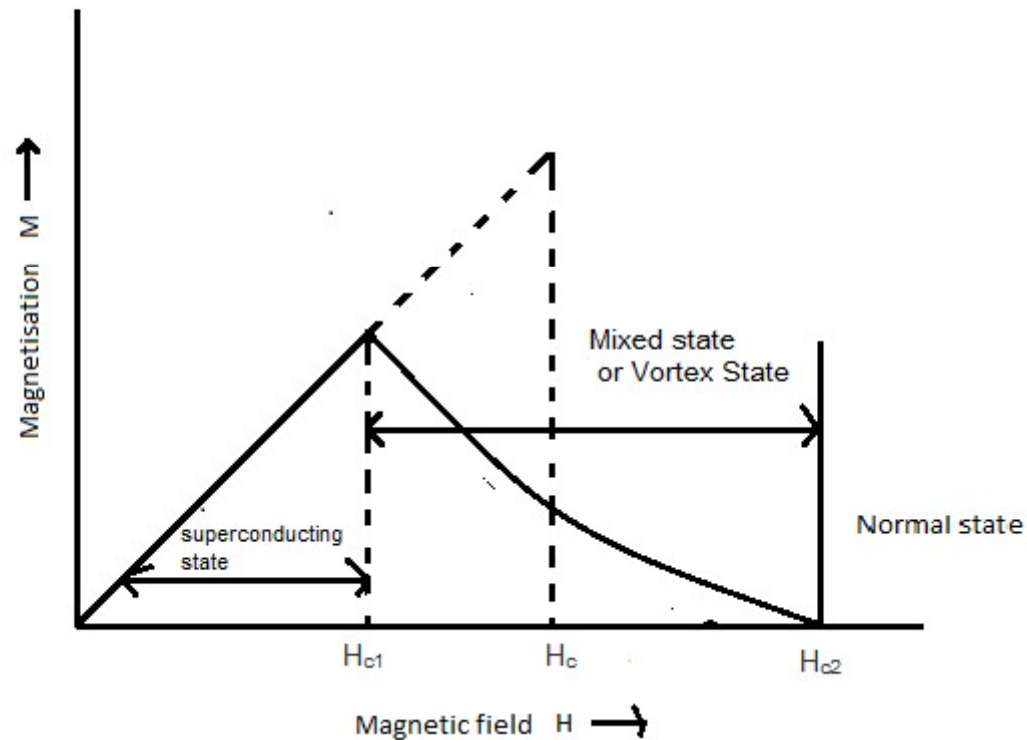


Magnetisation curve for type-I superconductor

- As value of magnetic field (H) increases, magnetisation of superconductor also increases. Above critical magnetic field (H_c) it turns into normal state.
- This is reversible process. When value of applied field decreases, material expels magnetic field lines and returns to superconducting state.
- Type-I superconductor allows magnetic field lines to penetrate at lower value of H_c . Therefore, it is also known as “Soft superconductor”.
- Mostly pure elements like Aluminum ($H_c = 0.0105$ Tesla), Zinc ($H_c = 0.0054$) etc. are examples of soft superconductors.

Type-II Superconductor

Type-II superconductors do not obey perfect Meissner effect.



- As value of magnetic field (H) increases, magnetisation of superconductor increases. Upto H_{c1} it shows perfect superconducting behavior.
- Above H_{c1} force of external magnetic field lines increases and it starts penetrating superconducting material. At H_{c2} material loses its superconductivity completely.
- The state between H_{c1} and H_{c2} is known as “Vortex state” or “Mixed state”.
- As to destroy superconductivity of type-II superconductor is difficult than type-I superconductor due to its high value of H_c , it is known as “Hard superconductor”.
- Mostly alloys and ceramics like NbN ($H_c = 8 \times 10^6$ Tesla), $BaBi_3$ ($H_c = 59 \times 10^3$ Tesla) are examples of hard superconductors.

Difference between Type-I and Type-II Superconductor

Type-I Superconductor	Type-II Superconductor
1. It obeys perfect Meissner effect and perfect diamagnetic behavior.	1. It does not obey Meissner effect.
2. Type-I superconductor has one critical magnetic field H_c and it shows sudden normal state above it.	2. It has two critical magnetic field H_{c1} & H_{c2} and it shows gradual decrement of superconductivity.
3. It has only two states i.e. superconducting and normal.	3. It has three states i.e. superconducting, mixed or vortex and normal state.
4. These superconductors are used less in practical applications as the H_c value is very low.	4. These superconductors are used more in practical applications as its H_{c2} value is very high.
5. These superconductors are also called as soft superconductors.	5. These superconductors are also called as hard superconductors.
6. Examples of soft superconductors are Zn, Al, Hg & Pb etc.	6. Example of hard superconductors are Nb, Zr, Nb-Ti alloy, Nb_3Sn etc.

THANK YOU