

4.8 Super Conductors and their properties

Super conductors

Super conductors are the materials which has zero resistivity and behaves as dia magnet below its transition temperature.

Transition temperature: The temperature at which the normal conductors changed into superconductor is called transition temperature.

Properties:

1. Electrical resistance: It has zero electrical resistance.
2. Effect of magnetic field :Super conducting property can be destroyed by the application of strong magnetic field.

The minimum field required to destroy the super conducting property is called critical field (H_c).

$$H_c = H_0 (1 - (T/T_c)^2)$$

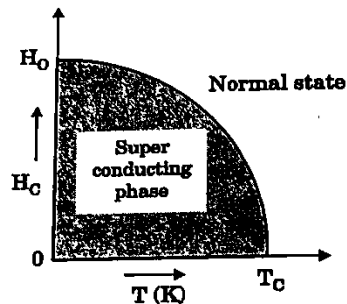


Fig. 6.2 Variation of H_c with T

3. Effect of heavy current:

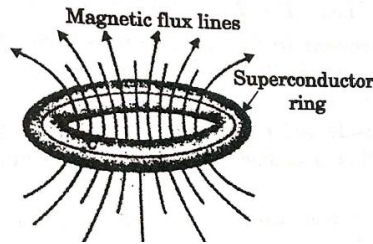
Superconducting property can be destroyed by the application of strong electric field.

Critical current required to destroy the superconducting property is $I_c = 2\pi r c$

4. Persistent current:

When a superconducting ring is placed in a magnetic field, current is produced in the ring.

This current persists in the ring without any



decrease in its value.

This current is called persistent current.

5. Meissner effect:

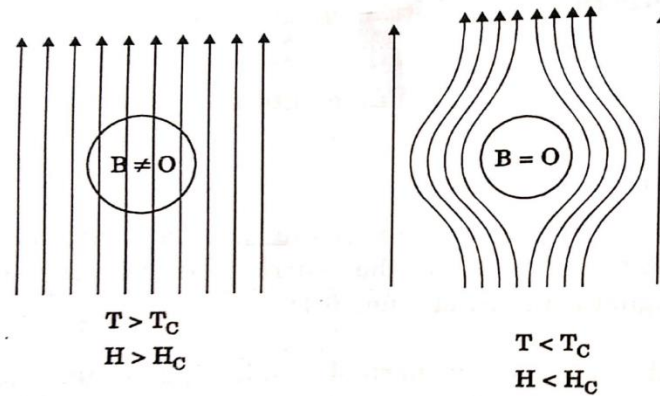
When the material is in normal conducting state the magnetic lines of forces pass through the material.

The material is cooled below its transition temperature the magnetic lines of forces are excluded from the material

Definition:

When a superconducting material is placed in a weak magnetic field and cooled

below its transition temperature the magnetic lines of forces are excluded from the material. This effect is called Meissner effect.



6.Isotope effect: The transition temperature is inversely proportional to the atomic masses.

$$T_c \propto 1/M^{\alpha}$$

7.Effect of pressure: Transition temperature is proportional to pressure.

8.Effect of stress: Transition temperature is increased by the stress.