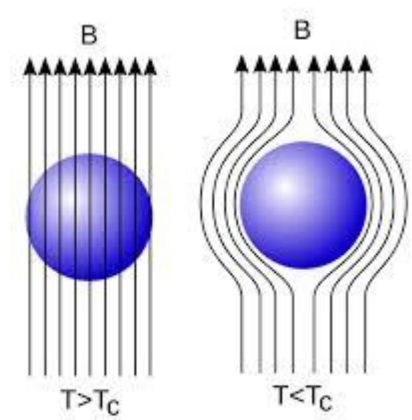
MEISSNER EFFECT

- *When a material makes the transition from the normal to superconducting state, it actively excludes magnetic fields from its interior; this is called the Meissner effect.*
- This constraint to zero magnetic fields inside a superconductor is distinct from the perfect diamagnetism which would arise from its zero electrical resistance.
- Zero resistance would imply that if you tried to magnetize a superconductor, current loops would be generated to exactly cancel the imposed field (Lenz's law).
- But if the material already had a steady magnetic field through it when it was cooled through the superconducting transition, the magnetic field would be expected to remain.
- If there were no change in the applied magnetic field, there would be no generated voltage (Faraday's law) to drive currents, even in a perfect conductor.
- Hence the active exclusion of magnetic field must be considered to be an effect distinct from just zero resistance. A mixed state Meissner effect occurs with Type materials.



***Type I superconductors**:*

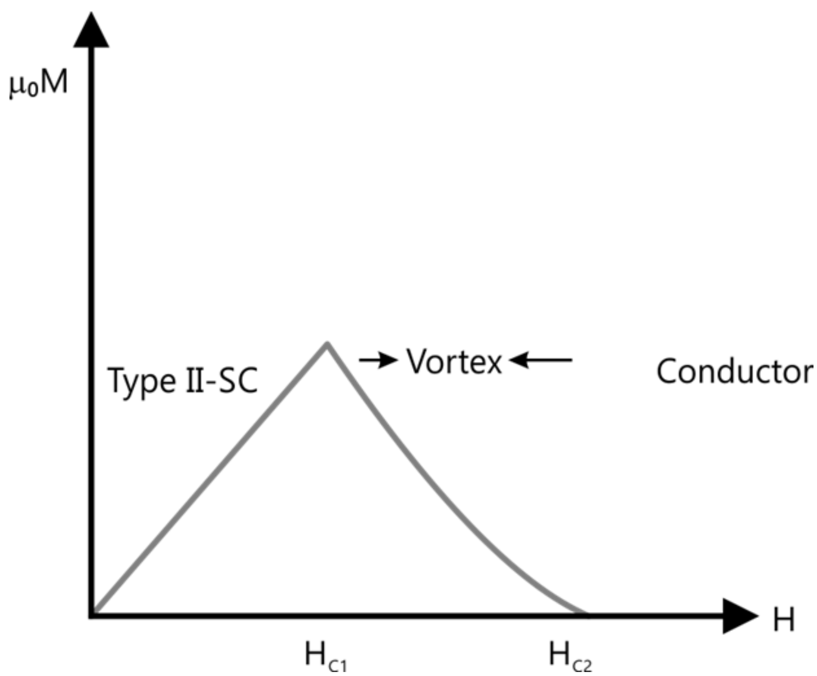
- Type I superconductors are those superconductors which lose their superconductivity very easily or abruptly when placed in the external magnetic field.
- From the graph of intensity of magnetization (M) versus applied magnetic field (H), we observe that, when a Type I superconductor is placed in the magnetic field, it suddenly or easily loses its superconductivity at critical magnetic field (Hc) (point A).

After Hc, the Type I superconductor will become conductor.

- Type I superconductors are also known as ***soft superconductors*** because of this reason that is they lose their superconductivity easily.
- Type I superconductors perfectly obeys Meissner effect.
- Example of Type I superconductors:
- Aluminum (Hc = 0.0105 Tesla), Zinc (Hc = 0.0054)

Type II superconductors*:*

- Type II superconductors are those superconductors which lose their superconductivity gradually*but not easily or abruptly* when placed in the external magnetic field.
- From the graph of intensity of magnetization (M) versus applied magnetic field (H), we can observe when the Type II superconductor is placed in the magnetic field, it gradually loses its superconductivity.
- Type II superconductors start to lose their superconductivity at lower critical magnetic field (Hc1) and completely lose their superconductivity at upper critical magnetic field(Hc2).



- The state between the lower critical magnetic field (Hc1) and upper critical magnetic field (Hc2) is known as vortex state or intermediate state.
- After Hc2, the Type II superconductor will become conductor.
- Type II superconductors are also known as hard superconductors because of this reason that is they lose their superconductivity gradually but not easily.
- Type II superconductors obey Meissner effect but not completely.
- Example of Type II superconductors:NbN (Hc = 8×106 Tesla), BaBi3 (Hc = 59×103 Tesla)