Superconductivity (lec-2)

According to Onnes the superconducting transition is reversible . if the superconducting specimen is heated , the normal resistivity at temperature T_C is again obtained .

Occurrence of Superconductivity :

Superconductivity has been found in different metallic elements of the periodic system , alloys intermetallic compounds and semiconductors .

It is matter to notice that some best conductors e.g . gold and copper etc are not superconductors

while some materials which are semiconductors at normal temperature become superconductors at sufficiently low temperatures .

Now a days the range of transition temperature exceeds from 23.2 K for the alloy Nb_3Ge to 0.01 K for few semiconductors .

Experimental facts of superconductivity

(i) Persistent currents : A current can be induced in a superconductor by electromagnetic induction when it has the form of ring . Now the ring is cooled in a magnetic field from temperature above the critical temperature T_C to below this temperature after some time the field is removed .

It was found that this current continues to persist without attenuation in a superconducting rings for more than a year . This current is known as ‘persistent current ‘ .This current decays with time is represented by the formula

$$I = I_0 e^{-\frac{R}{L}t}$$

Where L / R is called the time constant .

When R $\rightarrow$ 0 , L / R i.e . , time constant should be equal to infinity .Hence the current in a ring should flow for infinite period till the temperature remains the same . Due to this nature it is called persistent current .