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Explanation of Seeback and Peltier effects:

According to electronic Theory, The free electrons inside The metal move freely like The molecules of a gas in a Container. Therefore The free electrons are said to form a gas Known as electron gas. This electron gas is uniformly distributed insident The entire Volume of a metal. when The temp. of a metal is same every where, Then The density and Pressure of The electron gas inside The metal is also same everywhere. The density and Pressure of an electron gas differ from metal to metal even at The same temp. when two metals are joined together, The electron gas diffuse from on metal to The Other and vice versa in Such a way That The net diffusion of The electron gas is from a metal at high Pressure to That at low Pressure. Due to The diffusion of The electron gas an e.m.f is Produced at The junction of The two metals which opposes The diffusion The electron gas.

when This e.m.f. is Sufficient to stop The further net diffusion of The electron gas, Then The State of The dynamic equilibrium is reached. In The state of The dynamic equalibrium There exists a Certain e.m.f at The junction of The two metals which is Known a Peltier e.m.f. π.

Seeback Effect

When two dissimilar metals A and B (Say Cu and Fe) are joined together to form a Thermo-couple (fig-5), Then at each junction of Thermo-couple, a Peltier e.m.f. is Produced. If the two junctions are at The Same temp., Then The Peltier e.m.f.'s are equal and opposite. Therefore the net e.m.f. and hence The current in The Thermo-Couple is zero. If however the junctions are at different temp. T_1 and T_2 ($T_2 > T_1$), The Peltier e.m.f's π_1 and π_2 at The junctions are no longer equal So There is a resultant e.m.f $\pi_2 - \pi_1$ in The Circuit, due to which a Current flows in The Thermo-Couple. This explains seeback effect.

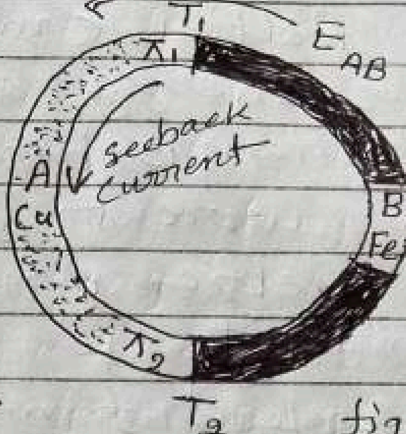

fig-5

Peltier effect :-

When two dissimilar metals A and B (Say Cu and Fe) and joined together to form a thermo-Couple (fig-5) Then at each junction a Peltier e.m.f. is Set up. Let The two junctions of The Thermocuple be at The Same temperature, Then The Peltier e.m.f's at The junctions are equal and opposite (i.e. $\pi_1 = \pi_2 = \pi$ Say).

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In The case of Fe - Cu junction, The Peltier e.m.f acts from Cu to Fe. When a current flows Through a junction from Fe to Cu by a battery of e.m.f. E_{AB}. it flows against The Peltier e.m.f and hence loses energy. This energy appears as heat and The junction is heated. At The other junction The current flows in The direction of The Peltier e.m.f; so that The Peltier e.m.f. itself does The work and energy is absorbed from The junction resulting into cooling of The junction. This explains Peltier effect.

Peltier Coefficient :-

The Peltier Coefficient of a junction of two dissimilar metals is defined as The amount of energy absorbed or evolved (in joules) when unit charge flows across The junction. It is denoted by π. Its Value depends on The Pair of metals in Contact and on The temp. of The junction.

Thus if a charge q Coulomb passes across a junction having a Peltier Coefficient π, Then the energy evolved or absorbed at the junction = eq joules.

Now if e is the e.m.f. set up at the junction (Peltier e.m.f.) then the energy absorbed or evolved at the junction = eq joules.

Therefore

$$\pi q = eq$$

or

$$\pi = e$$

Hence the Peltier coefficient expressed in joules per coulomb is numerically equal to the e.m.f. set at the junction in volts.

Cause of Peltier effect:-

If two dissimilar metals are joined, contact potential is established at the junctions i.e the potential of one must become above that of the other. For example: in Cu, Fe thermo-couple the potential of Fe is greater than the potential of Cu. At one junction, current flows from lower potential to a higher potential and the energy are required for this purpose, which is absorbed from the junction and hence it is cooled. At another junction, current flows from higher potential to lower potential. The energy is given out at this junction and makes the junction hot.