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Thomson Effect (2-2) (H2S) Paper IV

The absorption or evolution of heat energy if a current flows along a conductor when different parts of the conductor are at different temperatures is known as Thomson effect.

In substances like copper, silver, zinc, antimony and cadmium heat energy is absorbed when a current flows from a point at a lower temp. to a point a higher temp. Heat energy is, therefore, evolved when the current flows from a point at a higher temp. The Thomson effect for such substances is said to be positive.

In substances like iron, bismuth, cobalt, platinum and nickel heat energy is evolved when current flows from a point at a lower temp to a point at a higher temp. Heat energy is, therefore absorbed when the current flows from a point at a higher temp. to a point at a lower temp. Thomson Effect for such substances is said to be negative. In lead Thomson effect is zero.

* Peltier co-efficient :- In S.I unit Peltier co-efficient is defined as the amount of heat energy in Joules absorbed or evolved due to Peltier effect at a junction of two dissimilar metals when one ampere current flows for one second i.e, when a quantity of charge of

one coulomb passes through it. It is denoted by π.

The value of Peltier co-efficient is different for different pairs of metals. For the same pair of metals its value depends upon the temp. of the junction.

If a current i amperes flows for t seconds through a junction having a Peltier co-efficient π, then Heat energy absorbed or evolved $= \pi i t$ Joules

If V is the contact potential difference at the junction in volts, then

Heat energy absorbed or evolved $= Vit$ Joules.

$\therefore \pi it = Vit$ or $\pi = V$.

Hence Peltier co-efficient (in Joules per coulomb) at a junction is numerically equal to the contact potential difference (in volts).

* Thomson Co-efficient :- In S.I. units, Thomson co-efficient ~~measured in ergs per e.m.u of charge and~~ defined as the amount of heat energy in Joules absorbed or evolved due to thomson effect between two points of a conductor which differ in temp. by 1 K when one ampere current flows for one second i.e when a quantity of charge of 1 coulomb passes through it. It is denoted by σ.

Thomson co-efficient is not constant but varies in temperature.

If a current i ampere flows for t secon

between two points of a conductor having a difference of temp. of 1K and σ is Thomson co-efficient, then

Heat energy evolved or absorbed $= \sigma it$ Joules.

If V is the pd between the same two points in volts, then

Heat energy absorbed or evolved $= Vit$ Joules

$\therefore \sigma it = Vit$

Hence, Thomson co-efficient (in Joules per coulomb) is numerically equal to the difference of potential per degree Kelvin (in volts).