SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

23CHT101-Engineering Chemistry

Unit- I Electrochemistry

Electrode potential

Empathy question:

1. How chemical reactions occur in electrochemical cells, such as batteries, fuel cells, and corrosion processes.

A metal (M) consists of metal ions (M^{n+}) with valence electrons when the metal (M) is placed in a solution of its own salt, any one of the following reactions will occur.

1. Positive metal ions may pass into the solutions.

$M \longrightarrow M^{n+} + ne^-$ (oxidation)

2. Positive metal ions from the solution may deposit over the metal

$M^{n+} + ne^- \longrightarrow M$ (reduction)

Example 1) Zn electrode dipped in $ZnSO_4$ solution.

When Zn electrode dipped in $ZnSO_4$ solution, Zn goes into the solution as Zn^{2+} ions due to oxidation.

$$Zn \longrightarrow Zn^{2+} + 2e^-$$

Now the Zn electrode attains a negative charge, due to the accumulation of valence electrons on the metal. The negative changes developed on the electrode attract the positive ions solution. Due to this attraction the positive ions remain close to the metal.

➞Cu electrode dipped in $CuSO_4$ Solution

When Cu electrode is dipped in $CuSO_4$ solution, Cu^{2+} ions from the solution deposit over the metal due to reduction

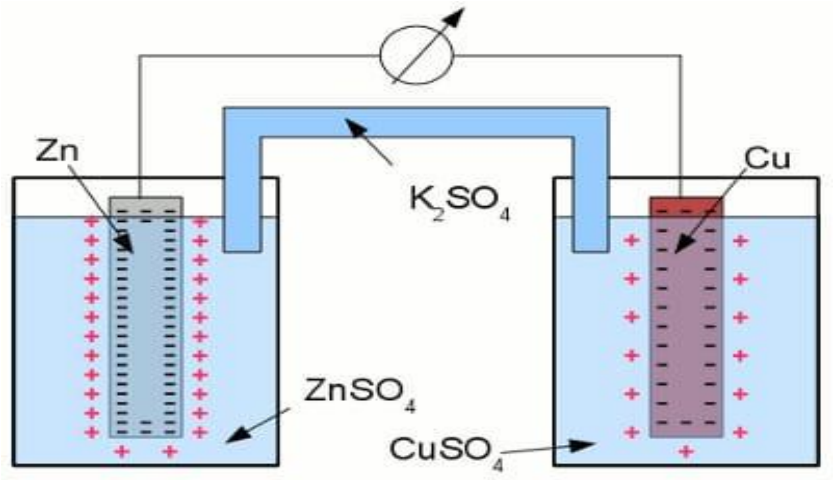
$$Cu^{2+} + 2e^- \longrightarrow Cu$$

Now, the Cu electrode attains a positive charge, due to the accumulation of Cu^{2+} ions the metal. The positive charge charges developed on the electrode attract the negative ions from the solution due to this attraction the negative ions remain close to the metal.

➞Zn electrode in $ZnSO_4$ solution

Thus, a sort of layer (+) or (-) ions is formed all around the metal. This layer is called Helmholtz electrical double layer. This layer prevents passing of the positive ions form or to the metal. A difference of potential is consequently set up between the metal and the solution.

At equilibrium, the potential difference between constant value, which is known as the electrode potential of a metal



OXIDATION POTENTIAL

If oxidation occurs at the electrode, at equilibrium, the potential of the electrode is oxidation potential. The tendency of an electrode to lose electrons is oxidation potential.

REDUCTION POTENTIAL

The tendency of an electrode to gain electrons is called reduction potential.

SINGLE ELECTRODE POTENTIAL (E)

It is a measure of tendency of metallic electrodes to lose or gain electrons, when it is in contact with a solution of its own salt.

STANDARD ELECTRODE POTENTIAL (E)

The tendency of metallic electrodes to lose or gain electrons when it is in contact with a solution of its own salt of 1 molar concentration at 298K