19CH101– ENGINEERING CHEMISTRY

Unit 2 – CORROSION AND ITS CONTROL

WET CORROSION

- The direct chemical action of environment on the surface of metal in presence of conducting liquid with the formation of electrochemical cells.
- It a common type of corrosion which occurs usually in aqueous corrosive environment • Occurs when metal comes in contact with a conducting liquid.
- Formation of galvanic cell on the surface of metal generating anodic and cathodic areas
- At anode oxidation takes place liberating electrons.
- Electrons at anode are transported to cathodic area where H+ or O2 and H2O consumes the electrons generating non-metallic ions like OH- or O2-
- Metallic (M+) and non metallic (OH- or O2-) diffuse towards each other and results in the formation of corrosion product in between the anodic and cathodic area.

Mechanism:

Electrochemical corrosion involves flow of electrons between anode and cathode. The anodic reaction involves dissolution of metal liberating free electrons

The cathodic reaction consumes electrons with either evolution of hydrogen or absorption of oxygen which depends on the nature of corrosive environment.

Wet corrosion takes place in two ways.

1. Evolution of Hydrogen
2. Absorption of Oxygen

Evolution of Hydrogen:

This type of corrosion evolution of hydrogen occurs in acidic medium. Let's considering the metal Fe, anodic reaction is dissolution of iron as ferrous ions with Liberation of electrons.

At Anode

Fe $\longrightarrow$ Fe2+ + 2e- (Oxidation)

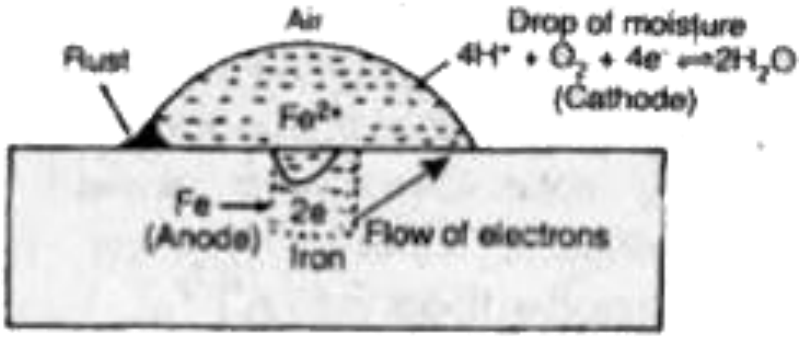
The electrons released flow through the metal from anode to cathode, whereas H+ ions of acidic solution are eliminated as hydrogen gas.

At Cathode

2H+ + 2e- $\longrightarrow$ H2 (Reduction) The overall reaction is: Fe + 2H+ $\longrightarrow$ Fe2+ +

H2

$$Fe_2O_3 + xH_2O \longrightarrow Fe_2O_3 \cdot xH_2O$$



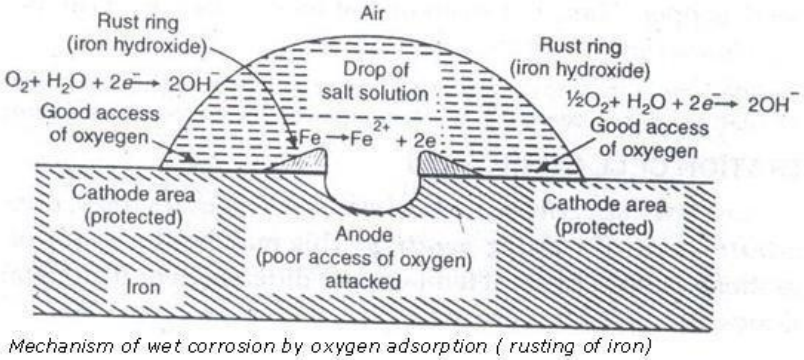
Absorption of Oxygen:

- This type of corrosion takes place in basic or neutral medium in presence of oxygen.
- For example, rusting of iron in neutral or basic aqueous solution of electrolyte in presence of atmospheric oxygen.
- Usually the surface of iron is coated with a thin film of iron oxide.
- If the film develops cracks, anodic areas are created on the surface and the rest of the metal surface acts as cathodes.
- It shows that anodic areas are small and the cathodic areas are large. The released electrons flow from anode to cathode through iron metal.

If enough oxygen is present, ferrous hydroxide is easily oxidized to ferric hydroxide and then to hydrated ferric oxide which is known as rust.

$4Fe(OH)2 + O2 + 2H2O \rightarrow 4Fe(OH)3$

The product called rust corresponds to Fe2O3.3H2O.



Mechanism of wet corrosion by oxygen adsorption (rusting of iron)