4.2 Electrochemical Corrosion (or) Wet Corrosion

Wet Corrosion Occurs

i) When two dissimilar metals are in contact with each other in presence of moisture.

ii) When a metal is exposed to varying concentration of oxygen or any other electrolyte.

Mechanism of Wet corrosion

- One part of metal becomes anode and another part becomes cathode
- At anode, oxidation occurs.
- At cathode, reduction occurs which depends on nature of environment.

  If the environment is acidic, hydrogen evolution occurs.

  If the environment is slightly alkaline or netural, oxygen absorption occurs.
- Metal ion form anode combines with non- metallic part from cathode to give the corrosion product between anode and cathode.

Wet Corrosion in Iron Rusting of Iron (Acidic Medium)
Hydrogen Evolution Type

At Anode

Iron undergoes dissolution to give Fe^{2+} with the liberation of electrons.

$Fe \longrightarrow Fe^{2+} + 2e^{-}$ (oxidation)

At Cathode

The liberated electrons flow from anodic to cathodic part where H^{+} ions get reduced to H_2.

$2H^{+} + 2e^{-} \longrightarrow H_2 \uparrow$

Then dissolution of metal starts.

Rusting of Iron (Neutral Medium)
Oxygen Absorption Type

At Anode

Iron undergoes dissolution to give $Fe2^{+}$ with the liberation of electrons

$Fe \longrightarrow Fe^{2+} + 2e^{-}$ (oxidation)

At cathode

The liberated electrons flow from anodic to cathodic part and combines with dissolved oxygen to form OH^{-} ions.

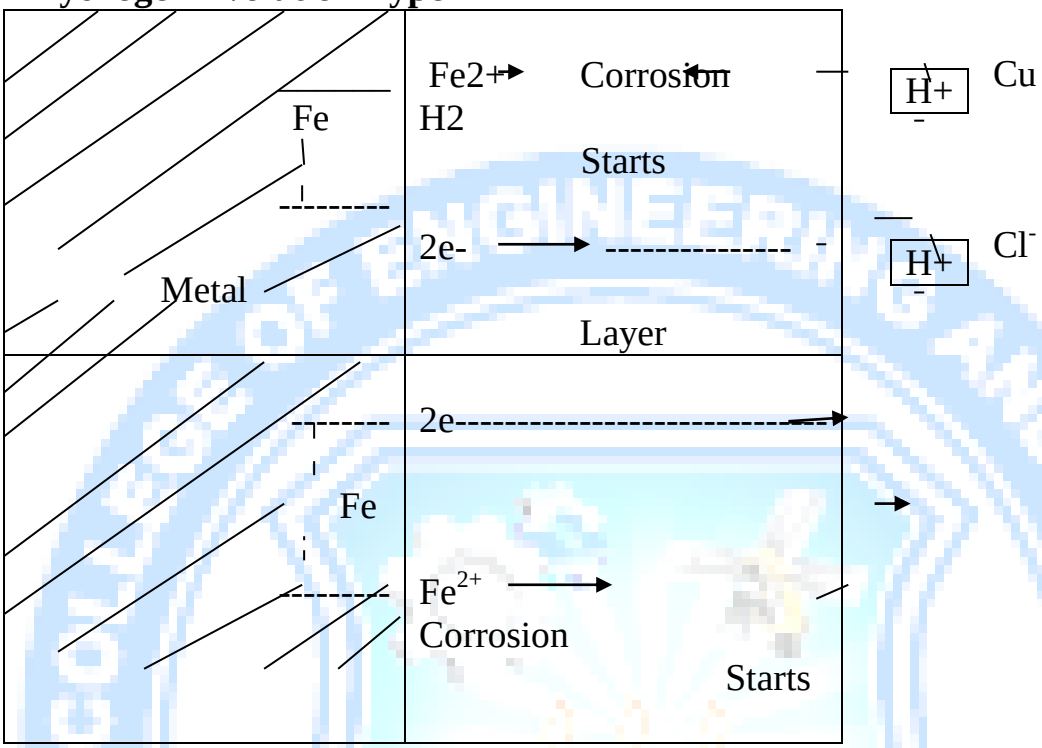
$\frac{1}{2} O_2 + H_2O + 2e^{-} \longrightarrow 2OH^{-}$ (reduction)

Net Reaction

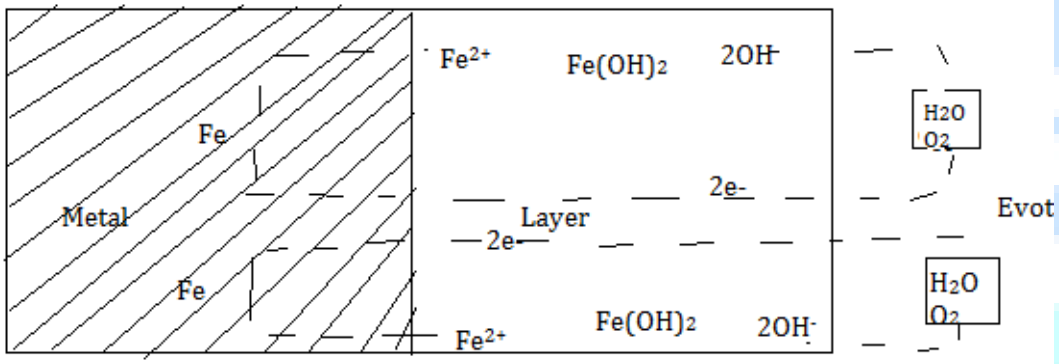
$Fe^{2+} + 2OH^{-} \longrightarrow Fe(OH)_2 \downarrow$

Fe(OH) $_2$ is easily oxidisaed to Fe (OH) $_3$ which further decomposes to form a rust (Fe_2O_3 , H_2O)

Hydrogen Evolution Type



Oxygen Absorption Type



Types of Electrochemical Corrosion

i) Galvanic Corrosion
ii) Differential Corrosion

Galvanic Corrosion

When two different metals come in contact in presence of an electrolyte galvanic corrosion occurs. Here

More active metal acts as anode

Less active metal acts as cathode

More active metal higher in EC series

Less active metal lower in EC series

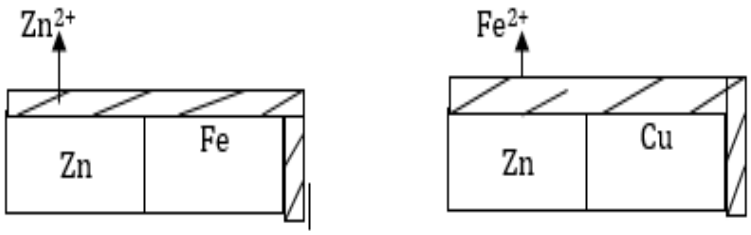
Example

i) Consider Zn – Fe couple

Here Zn is more active and Fe is less active. So zinc undergoes corrosion.

ii) Consider Fe – Cu couple

Here Fe is more active and Cu is less active. So Fe undergo corrosion.



iii) Steel screw in a brass marine corrodes . Here screw (Fe) acts as anode and brass (Cu) acts as cathode.

Prevention of Galvanic Corrosion

I) By avoiding the direct contact between the two metals.
II) By applying protective coating over metal surface.
III) By using bolt and nut made of same metal while joining the metal.

Differential Aeration Corrosion

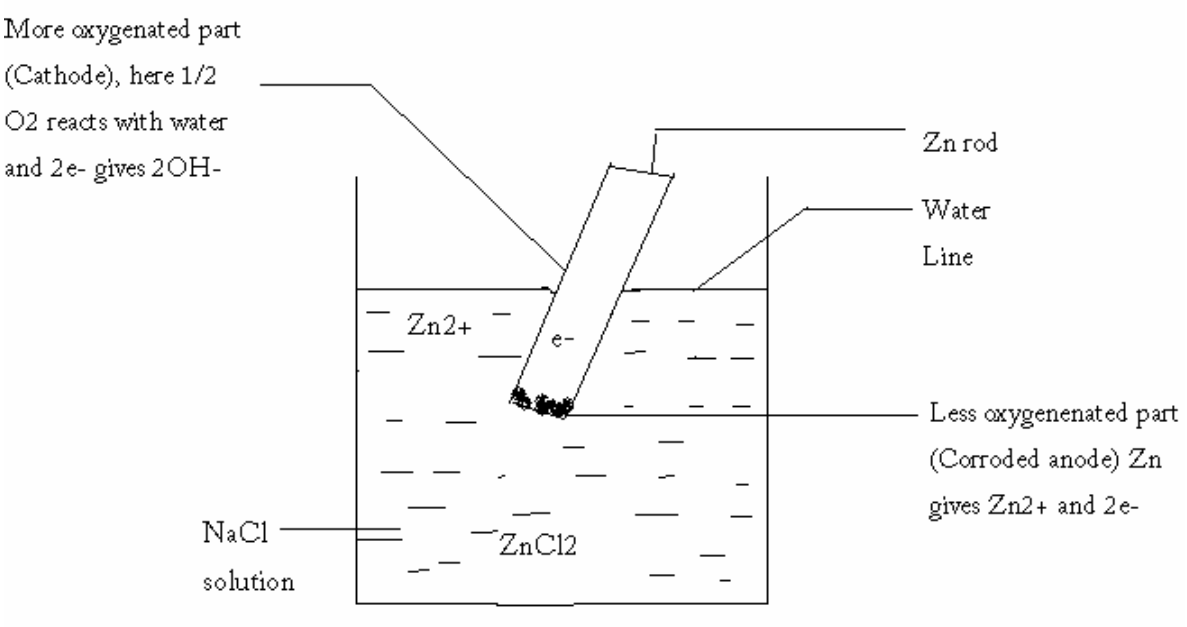
(Or)

Concentration Cell Corrosion

When a metal is exposed to varying concentration of electrolyte the part which is,

Less aerated metal acts as anode

More aerated metal acts as cathode

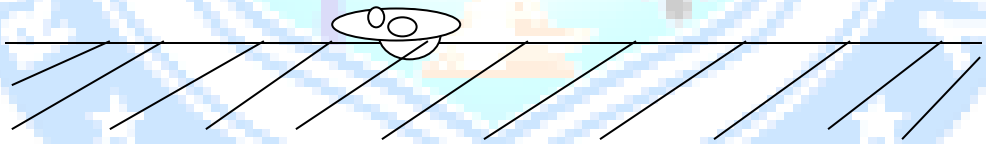


Types of Differential Aeration Corrosion

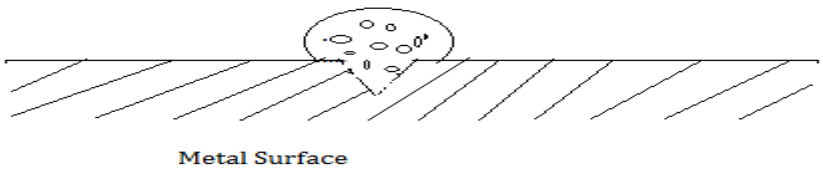
i) Pitting Corrosion
ii) Crevice Corrosion
iii) Pipeline Corrosion
iv) Wire fence Corrosion

Pitting Corrosion

Pitting is a located attack resulting in the formation of a bole around which the metal is relatively unattached.



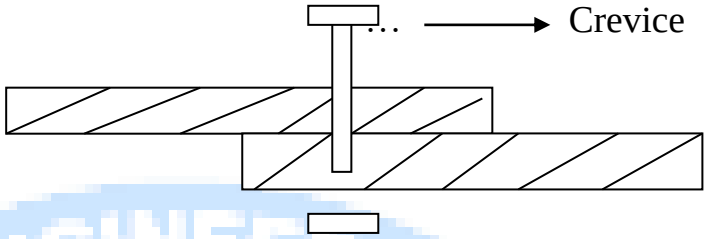
The area covered with water droplet is less aerated and it acts as anode and undergo corrosion. Due to this a pit is formed in the metal surface so it is called Pitting Corrosion.



Crevice Corrosion

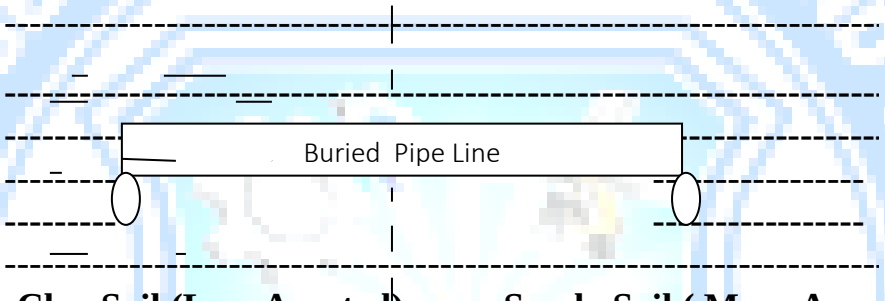
When two metals are ironed by bolt and nut, the crevice becomes anodic and undergoes corrosion. The exposed area act as cathode.

(anode)



Pipeline Corrosion

Burried pipeline or cables passing from one type of soil to another get corroded due to differential aeration corrosion.



-Clay Soil (Less Aerated)--------Sandy Soil (More Aera

Wire Fence Corrosion

In a wire fence, the areas where the wires cross are less aerated than the rest of the fence. So corrosion takes place at the wire crossing which are anodic.

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