

CORROSION AND BATTERIES

Corrosion is a process of gradual destruction of metal from its surface due to its unwanted chemical or electrochemical interaction of metal.

Ore of metal which is stable and is of less energy when provided energy is converted to pure metal which isn't stable and is of more energy. When this pure metal is exposed to the environment then it becomes corroded metal.

Corrosion is the reverse action of extraction of metal.

EFFECTS OF CORROSION

- Loss of useful property like malleability, and ductility.
- The loss of efficiency.
- The contamination of product.
- The decrease in production rate.

Examples of corrosion – rusting of iron, green film on copper surface

There are two types of corrosion:

- 1. DRY CORROSION** – The metals are in direct contact with the atmospheric gases like oxygen, hydrogen disulphide, sulphur dioxide, nitrogen etc.

Its types are:

OXIDATION CORROSION

- Direct action of oxygen will take place.
- Absence of water.

- At low temperature alkali metals are oxidized and at high temperature all metals are oxidized.

MECHANISM

- Metals get oxidized first.
- Electron is taken up by oxygen means reduction takes place.
- Formation of metal oxide takes place as the size of manganese ion is smaller than oxygen ion.
- Hence outward diffusion is faster.

Types of thin layers:

- Stable thin layer.
- Unstable thin layer.
- Volatile layer.
- Porous layer.

CORROSION BY OTHER GASES

Some other gases are chlorine, hydrogen disulphide, sulphur dioxide, carbon dioxide etc.

LIQUID METAL CORROSION

This type of corrosion occurs when liquid metals are allowed to flow over solid metals at high temperature.

2. WET CORROSION

It takes place in wet, moist conditions. The formation of short circuited galvanic cell takes place. At anode loss of electrons take place while at cathode gain of electrons take at place. Corrosion always occurs at anode. At cathode reduction takes place. Acceptance of electrons will take place.

MECHANISM

In this type the electron flows between the anode to the cathode. Cathodic reaction takes place either by

- Evolution of hydrogen – The corrosion occurs in acidic media. This type of corrosion causes displacement of hydrogen ions from the acidic solution by metal ions. So all metals above hydrogen in the electrochemical series have a tendency to get dissolved in the acidic solution. In this type of corrosion the anode have the large area and the cathode have the small area.
- Absorption of oxygen –Rusting of iron in presence of aqueous solution like NaCl or in presence of atmospheric oxygen. The surface of iron is usually coated with thin film of iron oxide. If this thin film develops some cracks anodic area are created on the surface. While all metals act as cathode. In this type of corrosion the anode are small and the cathode are large. Ferrous ions and hydroxide ion diffuse and when they meet ferrous hydroxide is precipitated. If enough oxygen is provided then ferrous oxide is oxidized to ferric hydroxide. This is called

as yellow rust. If the supply of oxygen is limited the corrosion product may be even black anhydrous magnetite.

DRY CORROSION	WET CORROSION
1. absence of water	Presence of water.
2. No cell formation takes place.	Cell formation takes place.
3. Caused due to gases.	Caused due to moisture.
4. It is of three types.	It is two types.
5. Direct chemical attachment.	Indirect chemical attachment.
6. Slow process.	Fast process.
7. Also known as chemical.	Also known as electrical.
8. It is uniform.	It is non-uniform.

RUSTING OF IRON

Stage 1: Ferrous ions go inside water and makes ferrous hydroxide.

Stage 2: Each ferrous ion leaves two electrons in metals.

Stage 3: The electron released by ferrous combines with hydrogen ion and gives hydrogen gas.

GALVANIC CORROSION OR BIMETALLIC CORROSION

When two dissimilar metals are connected and exposed to an electrolyte. The metal higher in electrochemical series undergoes corrosion. It gives capacity of two metals oxidation and reduction. The metal above hydrogen atom will act as anode.

EXPLANATION

Zinc as higher in electrochemical series forms anode and is attacked and gets dissolved. Whereas copper lower in series acts as cathode.

MECHANISM

The electric current flows from the anodic metal zinc to cathode.

Examples – Steel screws in hard brass marine hardware. Lead antimony solders around copper wire. Steel pipe connected to copper plumbing.

CONCENTRATION CELL CORROSION OR DIFFERENTIAL AERATION CORROSION

This type of corrosion occurs when a metal is partially immersed in an electrolyte and partially exposed to air. The concentration of oxygen varies on the same metal. Half metal is immersed in water and is exposed to less oxygen (anode). Half metal isn't immersed in

water and is exposed to more oxygen (cathode). So a differential aeration causes a flow of current called as differential current. For example

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