ELECTRO CHEMISTRY

TOPIC-8
Corrosion mechanism, preventions and control, Lead accumulator

VERY SHORT ANSWER QUESTIONS

1. What is corrosion?
Ans:

Corrosion is the disintegration of an engineered material into its constituent atoms due to chemical reactions with its surroundings. In the most common use of the word, this means electrochemical oxidation of metals in reaction with an oxidant such as oxygen. Formation of an oxide of iron due to oxidation of the iron atoms in solid solution is a well-known example of electrochemical corrosion, commonly known as rusting. This type of damage typically produces oxide(s) and/or salt(s) of the original metal.

2. What is passivation?

Ans:
Passivation is the process of making a material "passive", usually by the deposition of a layer of oxide on its surface. In air, passivation affects the properties of almost all metals–notable examples being aluminium, zinc, titanium, and silicon (a metalloid). In the context of corrosion, **passivation** is the spontaneous formation of a hard non-reactive surface film that inhibits further corrosion. This layer is usually an oxide or nitride that is a few nanometers thick.

3. What is galvanic corrosion?
Ans: Galvanic corrosion is an electrochemical process in which one metal corrodes preferentially to another when both metals are in electrical contact and immersed in an electrolyte. The same galvanic reaction is exploited in primary batteries to generate a voltage

SHORT ANSWER QUESTIONS\

1. What is the mechanism of corrosion?
Ans:

Any process of deterioration (or destruction) and consequent loss of a solid metallic material, through an unwanted (or unintentional) chemical or electrochemical attack by its environment, starting at its surface is called corrosion. The most familiar example of corrosion is rusting of iron. Thus corrosion is a process reverse of extraction of metals.

Classification of Corrosion

Based on the mechanism of corrosion, it is classified into two types

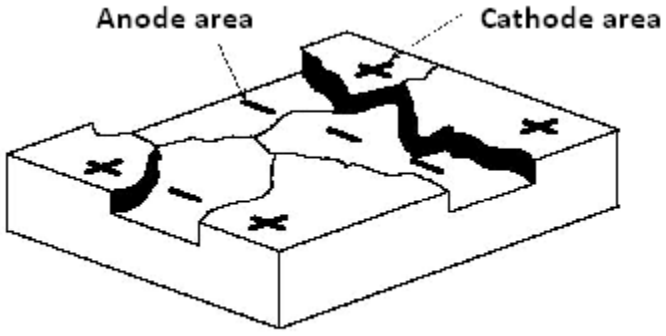
1. Chemical or dry corrosion
2. Electrochemical or wet corrosion

Dry corrosion:

- Corrosion takes place in dry state.
- In occurs due to the direct chemical attack of the metal by the environment.
- Corrosion products accumulate on the same spot, where corrosion occurs.
- Dry corrosion is self controlled.
- It follows absorption mechanism.
- Homogenous metal surface undergoes corrosion observed.
- Uniform corrosions are observed. Example: Formation of mild iron oxide on its surface.

Wet corrosion:

- Corrosion takes place in the presence of moisture.
- It occurs due to the setting up of large numbers of galvanic cells.
- Corrosion products accumulate on cathode.
- Wet corrosion is continuous process.



Wet corrosion

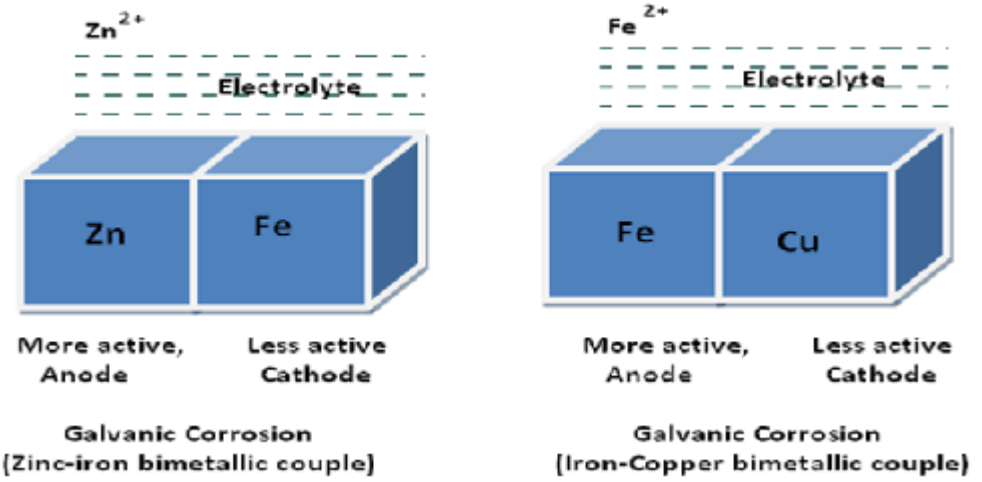
- It follows electrochemical mechanism.
- Heterogeneous metals bimetallic surface is the condition for corrosion.
- Pitting corrosions are observed.

Example: Formation of rust on iron under moist atmosphere.

Some Types of Corrosion

1. **Galvanic or Bimetallic corrosion**

When two dissimilar metals are contact with each other in presence of an electrolyte, the metal higher in electrochemical series undergoes corrosion. This corrosion is known as galvanic corrosion.



Example: Zinc and copper, zinc forms the anode and is attacked and gets dissolved, whereas copper acts as cathode.

2. Granular corrosion

When a molten metal in cast, the solidification starts at many randomly distributed nuclei. Each of them grows in a regular array to form grains. Because of random nucleation, the planes of atoms in neighbouring grains do not match up. Such areas of mismatch between the grains are called grain boundaries.

Example for granular corrosion is welding of stainless steel.

2. Stress corrosion cracking

The cracking of metal alloy by simultaneous action of tensile stress and corrosive environment is known as stress corrosion cracking. The stressed area act as anode and unstressed area act as a cathode. It occurs in certain metal- environment combinations only. Cathodic protection can be applied to delay or stop the failure.

3. Differential aeration corrosion or concentration cell corrosion

This type of corrosion is due to electrochemical or wet attack on the metal surface, exposed to an electrolyte of varying concentrations or of varying aeration. This may be the result of local difference in metal-ion concentrations caused by local temperature differences or slow diffusion of metal-ions produced by corrosion. Poor oxygenated parts are anodic and highly oxygenated parts are cathodic.

2. How Corrosion can be prevented?

Prevention of Corrosion

Iron and steel (alloy of iron) are most easily protected by paint which provides a barrier between the metal and air/water. Moving parts on machines can be protected by a water repellent oil or grease layer. Covering the surface with enamel and lacquers is another method.

Sacrificial Protection

'Rusting' can be prevented by connecting iron to a more reactive metal (e.g., zinc or magnesium). This is referred to as sacrificial protection or sacrificial corrosion, because the more reactive protecting metal is preferentially oxidized away, leaving the protected metal intact.

Alloying

Iron or steel along with other metals can also be protected by 'alloying' or mixing with other metals (e.g., chromium) to make non-rusting alloys. Stainless steel is an example of a non-rusting alloy of iron and carbon. Brass, an alloy containing copper is another metal alloy which is less expensive and non reactive.

Galvanizing

Coating iron or steel with a thin zinc layer is called 'galvanizing'. This layer is produced by electrolytic deposition. Dipping the iron/steel object in molten zinc and using it as the negative cathode zinc is coated on it. Zinc preferentially corrodes or oxidizes to form a zinc oxide layer that does not flake off like iron oxide rust. Also, if the surface is scratched, the exposed zinc again corrodes before the iron and continues to protect it.

Electroplating

Coating the surface with metals like tin, chromium, nickel etc. by electroplating is also utilized to prevent corrosion. Steel cans are protected by relatively un-reacted tin and works well as long as the thin tin layer is complete.

LONG ANSWER QUESTIONS

1. What is corrosion? Explain different types of corrosion and how corrosion can be prevented?

Ans:

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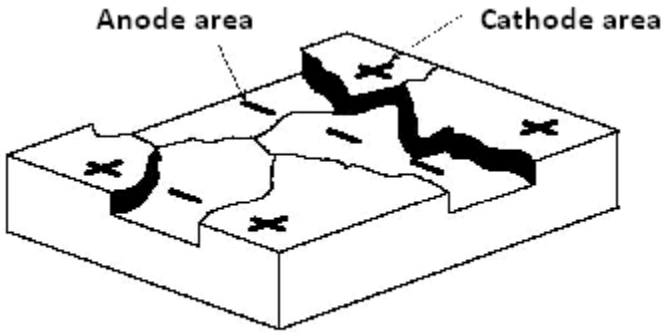

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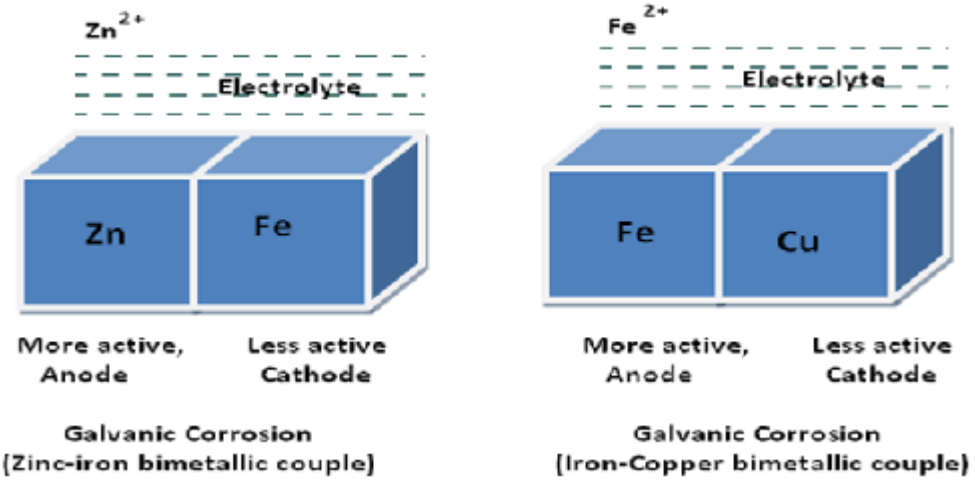

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IMPORTANT QUESTIONS

I. Long answer Questions.

1. What is specific, equivalent and molar conductance? Explain and write the equations?
2. What is Kohlrausch law? Give its applications?
3. What are primary and secondary cells? Explain with examples?
4. What are fuel cells? Explain with examples?
5. What is corrosion and how is it prevented?

II. Short answer Questions

1. State Faraday's laws of electrolysis?

2. What is lead accumulator?

III. Short answer Questions

1. What is corrosion?

2. What is passivity?

3. What is electrolysis? Illustrate.

4. Write equation for specific conductance?

4. What is fuel cell?