Engineering Chemistry

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CO-2

Home Assignment - 02

Q) Discuss the mechanism involved in the chemical and electrochemical theroy of corrosion.

Ans) **Mechanism of corrosion:**

Corrosion is the deterioration of metals due to environmental reations, primarily categorized into chemical (dry) and electrochemical (wet).

1) **Chemical Theory of Corrosion (Dry Corrosion):**

Chemical corrosion occurs through direct reations between metals and glas (like oxygen or sulpur dioxide) without needing an electrolyte. This usually happens at high temperatures.

- Mechanism: Metal oxide oxidize, forming a metal oxide layer on the surface. For instance, Fe reats with O_2 at high temperatures to produce iron oxide (Fe_2O_3).
- Protective Layer: In some metals, the oxide layer is stable and shields the surface. However, if the oxide layer is porous or non-adherent, as with rust on iron, corrosion progresses.

[cont..]

2) Electrochemical Theory of corrosion (wet corrosion):

Electrochemical corrosion is more common and occurs in the presence of an electrolyte (water or moisture), forming anodic and cathodic regions on the metal surface.

- Anodic reaction (oxidation): Metal atoms at anodic sites release electrons and dissolve as ions. For example, iron oxides to Fe^{2+} ions.
- Cathodic reaction (Reduction): Electrons move to cathodic sites, where they reduce oxygen to form hydroxide ions:

In neutral environments: $O_2 + 2H_2O + 4e^- \longrightarrow 4OH^-$

- Formation of rust: Iron ions combine with hydroxide ions, eventually forming rust ($Fe_2O_3 \cdot xH_2O$)

Electrochemical corrosion results in surface pitting and structural weaking, especially in moist environments.