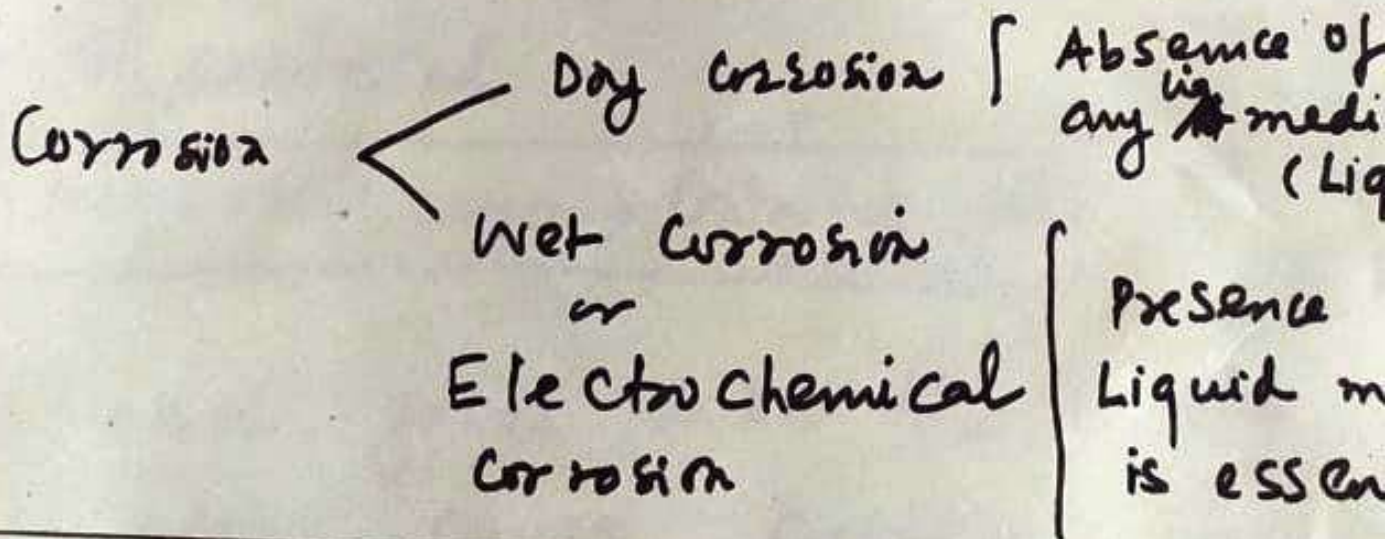


Review of Lecture 1:

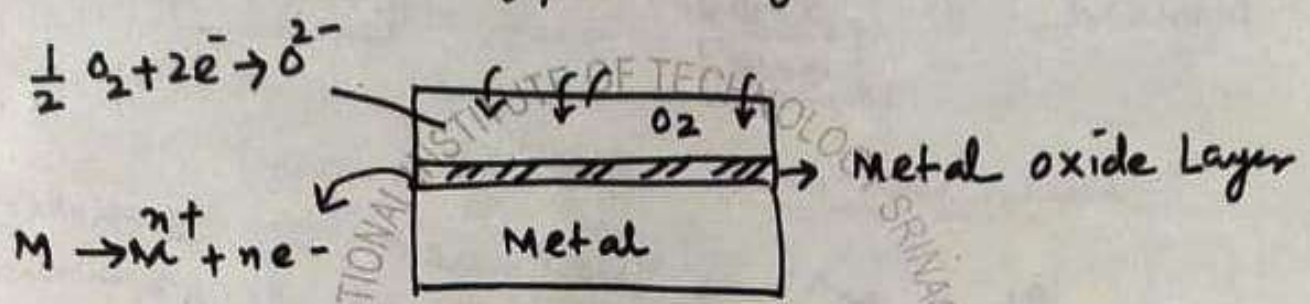
- Corrosion is an unwanted, undesirable chemical or electrochemical reaction  
→ Can not be removed, can be controlled.
- oxide layer formed will be deciding factor for further corrosion
- Pilling - Bedworth rule gives an idea about the rate of further corrosion.

In ~~Next~~ Lecture 2: we shall be taking types of corrosion.



Mechanism of Dry Corrosion: (P 2)

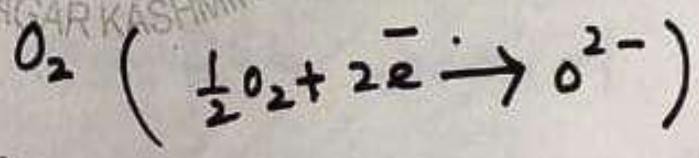
Let us consider a metal surface interacting / reacting with a gas.



Rxn at metal



Oxygen utilises these  $e^-$  to ~~get~~



undergoes ~~reduced~~ reduction

$M^{n+}$  - moves

$O^{2-}$  → Also moves

$M_2O_n$  → Takes place at the point of combination of  $M^{n+}$  and  $O^{2-}$

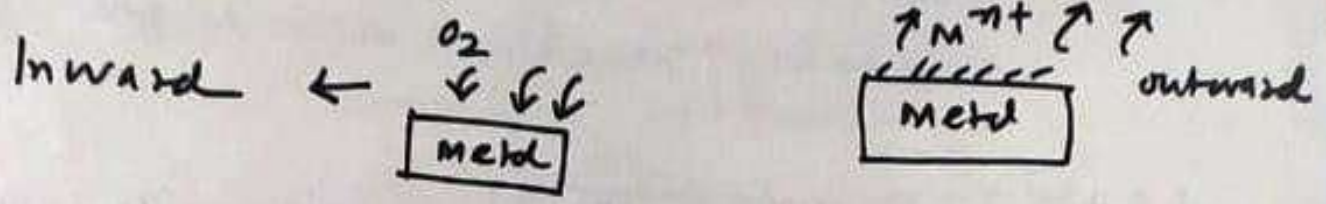
⇒ Resulting metal oxide acts as a



barrier or protective cover for further oxidation to undergo.

⇒ when  $M^{n+}$  &  $O^{2-}$  moves.

$M^{n+} \rightarrow$  outward movement  
 $O^{2-} \rightarrow$  inward movement



Which will move quickly?

It is  $M^{n+} \rightarrow$  because of smaller size than  $O^{2-}$

Therefore outward diffusion of  $M^{n+}$  is more faster than  $O^{2-}$ . Inward diffusion will be slow.

If there will be cracks, then corrosion will be continuous, otherwise it will be controlled

Metal oxide Layer  $\rightarrow$  Controlling the corrosion

Further other gases like  $Cl_2, H_2$  etc can also cause corrosion.

$\rightarrow$  Liquid metal corrosion  $\rightarrow$  Na metal leads to corrosion of cd in nuclear reactor.



# Electrochemical or wet corrosion

Pre-requisite : Wet or moist Condition through the formation of anodic and cathodic reactions.

— Wet corrosion is more common than dry corrosion.

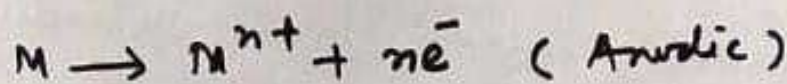
## Features/ characteristics

- Separate anodic and cathodic rxns, hence areas also,
- Between cathodic and anodic area current flows through conducting medium.
- Oxidation at Anodic Area which generates metallic ions.
- Non-metallic ions like  $\text{OH}^-$  or  $\text{O}^{2-}$  are formed at cathodic area.
- Diffusion of metallic & non-metallic ions between each other through conducting medium & formation of corrosion product.



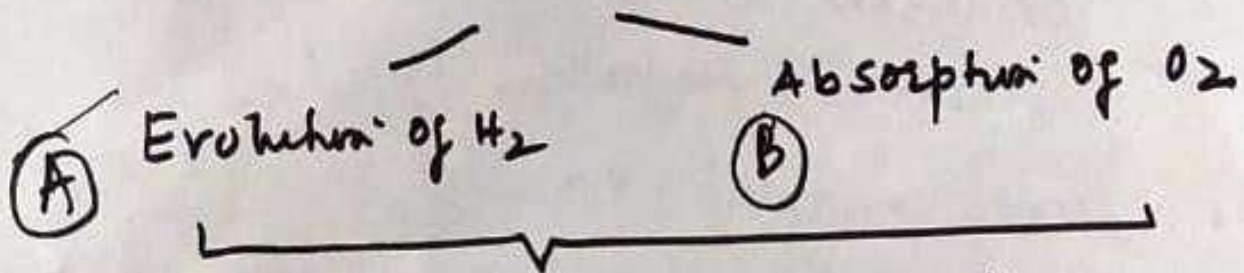
## Mechanism of Electrochemical or Wet Corrosion

- A conducting liquid in contact with a metal (or)
- when two dissimilar metals or alloys are either immersed (or) dipped partially in a solution.
- Anodic Area - Oxidation  
Cathodic Area - Reduction.



Cathodic Rxns  $\rightarrow$  Environment or Nature of Conducting medium may decide further course of action.

Mechanism here follows two ways



Both depends upon the nature of Corrosive Environment.

A) Evolution of H<sub>2</sub>  
occurs.

1) In acidic Environments.  
Example: Corrosion of Fe Metal.

Cathodic  
Rxn

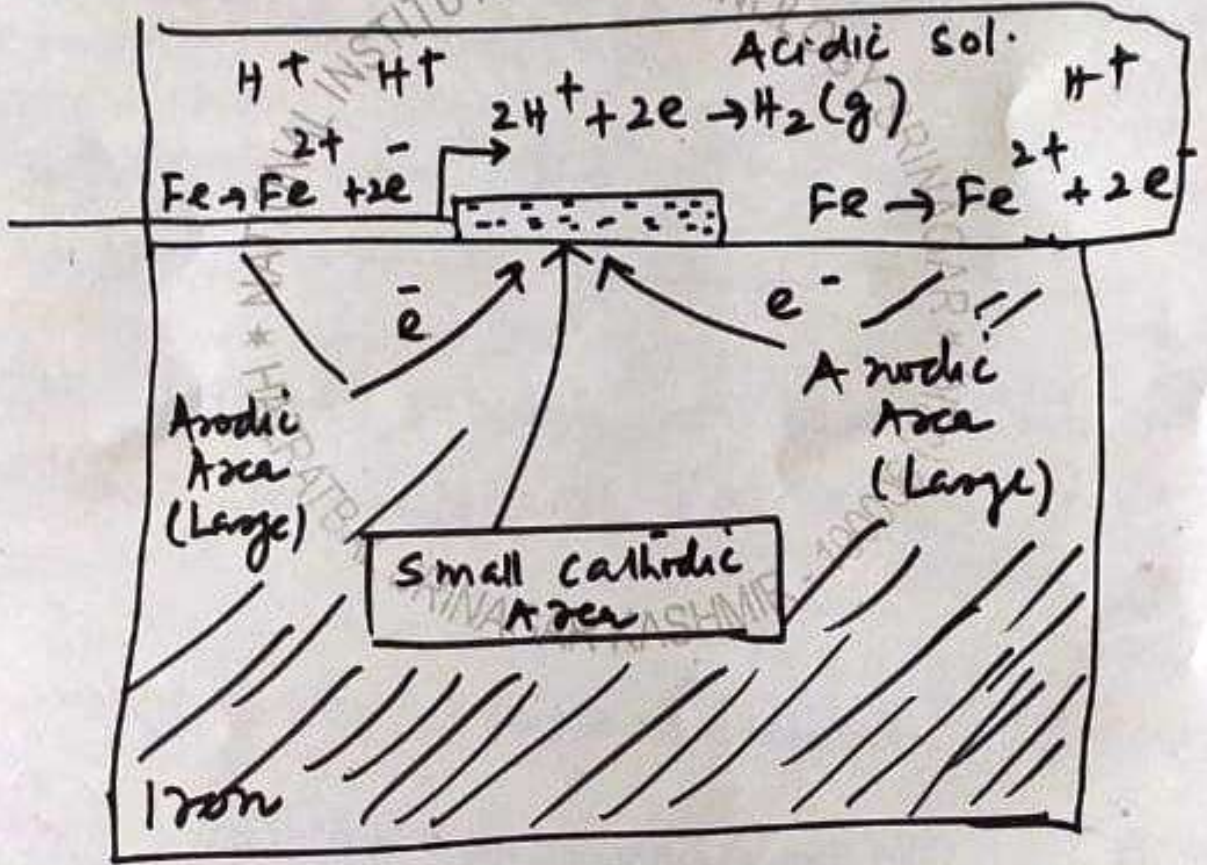


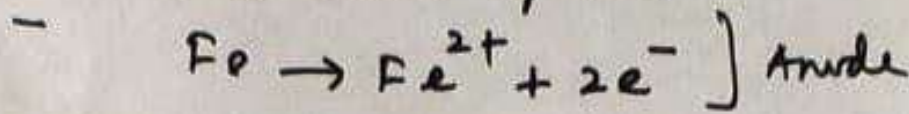
Figure A:

Mechanism of wet corrosion  
by Evolution of Hydrogen

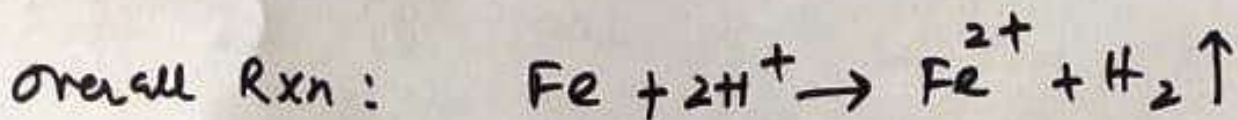
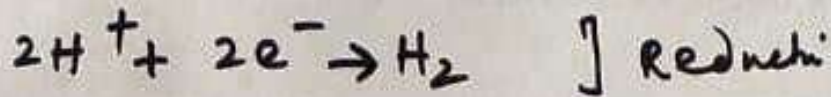


Anodic Rxn:

Dissolution of Fe



→ These  $e^{-}$ s flow through the metal from anode to cathode (Acidic Region) where  $H^{+}$  ions are eliminated as  $H_2$  gas



In this process - Anodes & are very large  
Cathodes are small.

⇒ All metals above Hydrogen in the electrochemical series have a tendency to get dissolved in acidic solution with simultaneous evolution of Hydrogen

---

B.

P(8)

Absorption of oxygen type  
corrosion

Pre-requisite with example:

Example: Rusting of Fe in neutral  
aqueous solution of electrolytes  
like NaCl in the presence  
of atmospheric oxygen

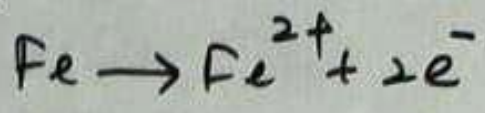
→ Surface of iron will be usually  
coated with a thin film of  
iron oxide.

→ If this oxide film develops  
some cracks, anodic area is  
thus created.

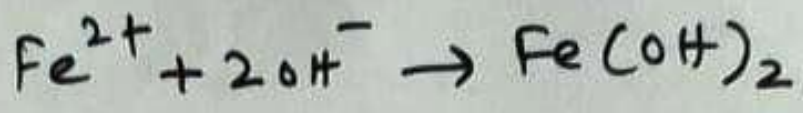
→ Pure metal part acts as Cathode  
So → here Anodic part — Small  
Cathodic part — Large.



Anodic Rxn:



Cathodic Rxn  $\frac{1}{2}O_2 + H_2O + 2e^{-} \rightarrow 2OH^{-}$



If enough  $O_2$  is present.

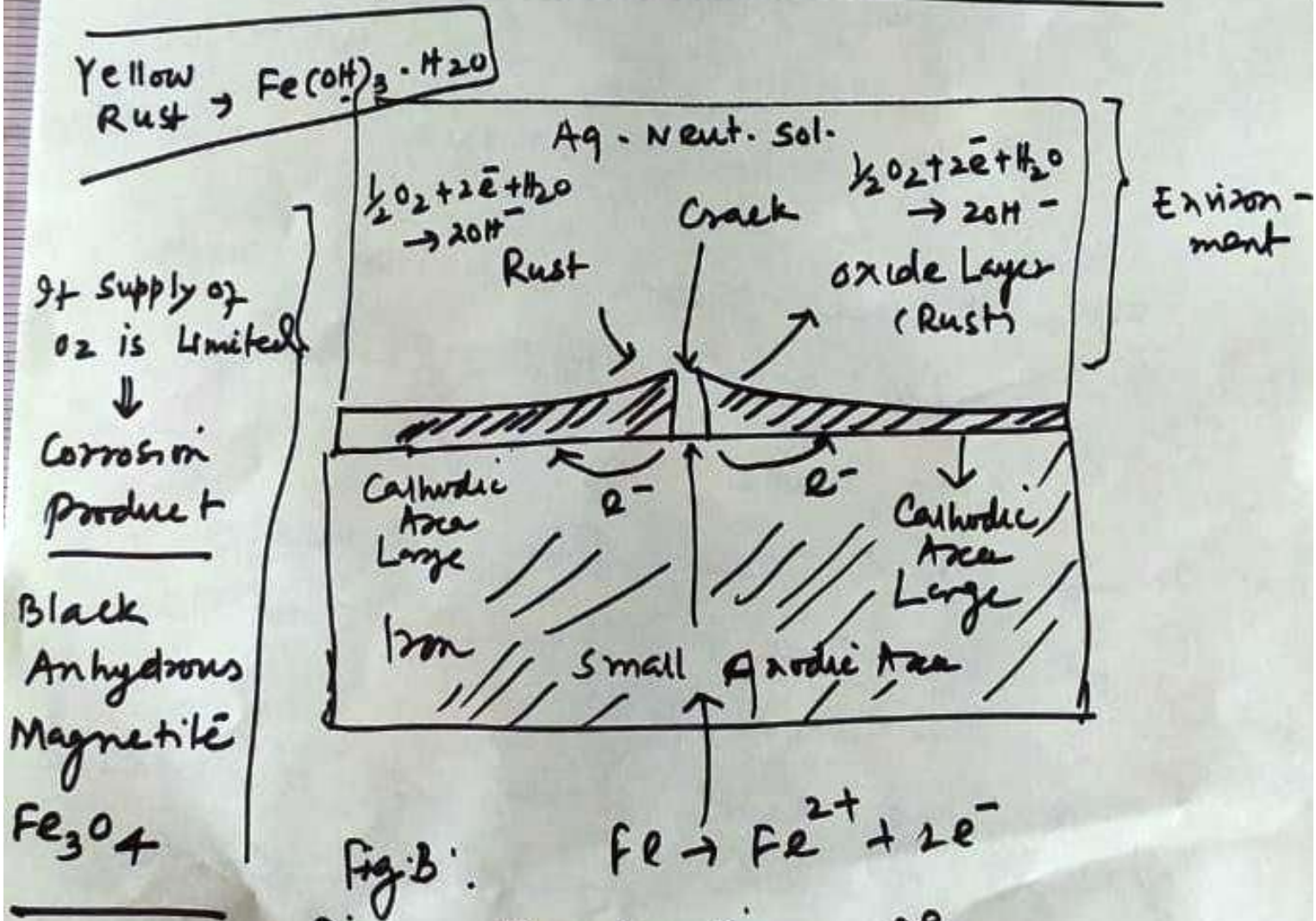
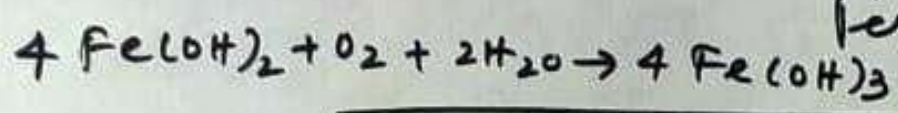
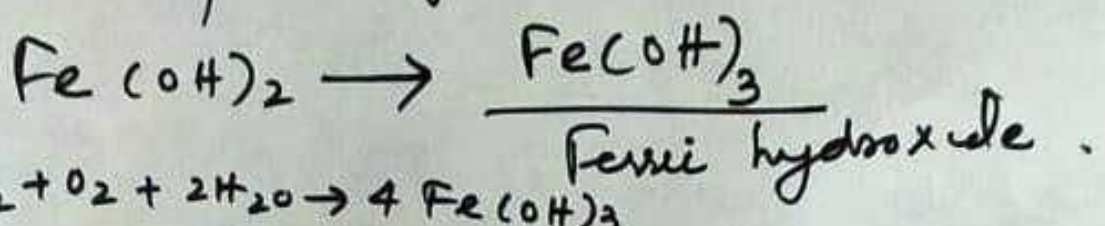


Fig. B:  $Fe \rightarrow Fe^{2+} + 2e^{-}$

Fig. B -> Mechanism of wet corrosion by oxygen Absorption