

## Chapter 11

# Principles of Metallurgy

### Corrosion:

Corrosion is the process of formation of undesirable compounds of a metal, due to its interaction with atmosphere.

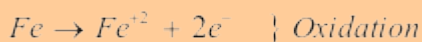
#### Ex.

- Rusting of iron. Iron due to its interaction with atmosphere forms Iron oxide.
- Tarnishing of silver. Silver get interacted with sulphur to form sulphide.
- Development of a green layer on copper. Copper gets converted into its carbonate.

### Mechanism of rusting of iron:

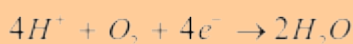
Mechanism of rusting of iron can be considered as an electrochemical process.

- Surface of the metal can be considered as an electrochemical cell, where metal gets oxidised.
- Metal iron when exposed to atmosphere in presence of moisture gets oxidised to form ferrous ( $\text{Fe}^{+2}$ ) ions.

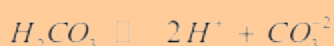
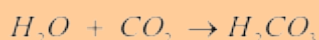


- The electrons released will be transferred to another place, where reduction occurs.

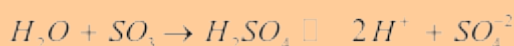
- Oxygen present in the atmosphere converted into oxide ions, in presence of  $H^+$  ions.



- $H^+$  ions are supposed to be produced due to dissolution of  $CO_2$  in water.



- $H^+$  ions can also be produced due to dissolution of other oxides into water.



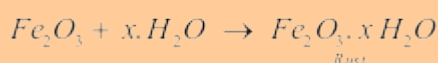
- Ferrous ( $Fe^{+2}$ ) ions produced are further oxidised in presence of atmosphere oxygen and oxidizing agents to give ferric ( $Fe^{+3}$ ) ions.



(Or)



- Ferric ions gets hydrated to form hydrated oxide of iron, which is also known as rust.



## Prevention of corrosion:

It can be done by different methods.

- Painting the object or coating with suitable chemical, which can prevent corrosion.

**Ex.** Bisphenol can be used as chemical, which can prevent corrosion.

- Coating of metal object with less reactive metal, it means which is inert towards atmospheric reactions or reacts with atmospheric components to form a protective coating.

**Ex.** Coating of Iron object with Zinc. Zinc reacts with atmosphere to form protective coating.

- Coating of other objects with aluminium. Aluminium forms a protective coating due to reaction.

## Sacrificial protection:

The metal is attached with another more reactive metal, which is made as anode. Being more reactive metal gets oxidised, required object is protected from corrosion.

- More reactive metals like calcium, magnesium are attached to the object to be protected.

## Alloying:

Alloying can improve properties of metal, so that reduce, chemical reactivity, means reactivity towards atmosphere or other chemicals.