

7. Factors affecting rate of corrosion (cont.)

30 October 2023 17:09

Ratio of anodic to cathodic area

large cathodic region \rightarrow e^- liberated by anode consumed rapidly \rightarrow e^- demand high \rightarrow corrosion rate increases rapidly to release more e^-

Hydrogen overvoltage

Overvoltage: Extra voltage above theoretical value required for electrode reaction to occur
Applicable especially for evolution of gases.

- If overvoltage of a gas is high \rightarrow Evolution of gas is less
- Depends on surface

Hydrogen evolution \rightarrow cathodic reaction

Cathodic reaction becomes faster \rightarrow Anodic reaction becomes faster \rightarrow Corrosion rate increases.

But with increase in hydrogen overvoltage, hydrogen evolution becomes slower.

\uparrow hydrogen overvoltage \rightarrow rate of corrosion \downarrow

Temperature

For corrosion (redox reaction),

\uparrow Temp = \uparrow Corrosion

- Rate of reaction increases
- Conductance of medium increases (ions migrate faster)
- Breakdown of protective layers
- Decrease in polarization effect at anode, cathode
- Increase of solubility of corrosion product

For corrosion due to dissolved gases (O_2 , CO_2 etc)

\uparrow Temp = \downarrow solubility of gas = \downarrow Corrosion

pH

Lower pH of corrosive medium = higher corrosive rate

low pH \rightarrow high concentration of H^+ \rightarrow increases rate of cathodic reaction
 $2H^+ + 2e^- \rightarrow H_2$

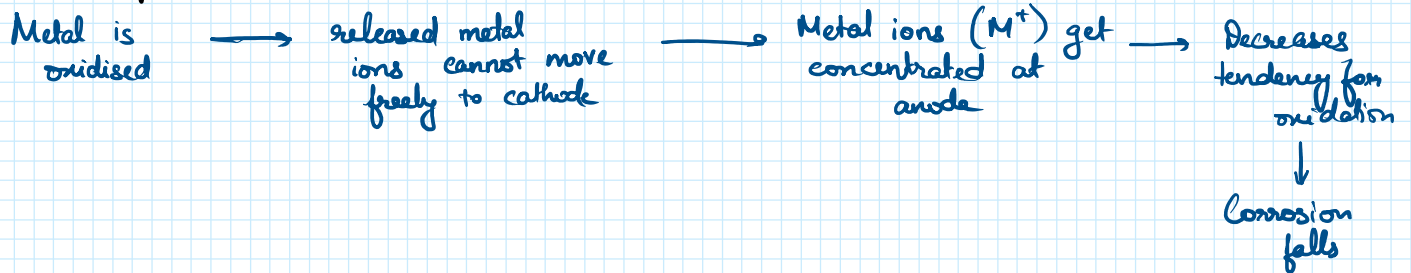
increases rate of anodic reaction

- Corrosion product solubility high in acidic medium
- Some metals like Al undergo fast corrosion in alkaline $\xrightarrow{\text{why?}}$ protective layer soluble in alkaline

Polarisation

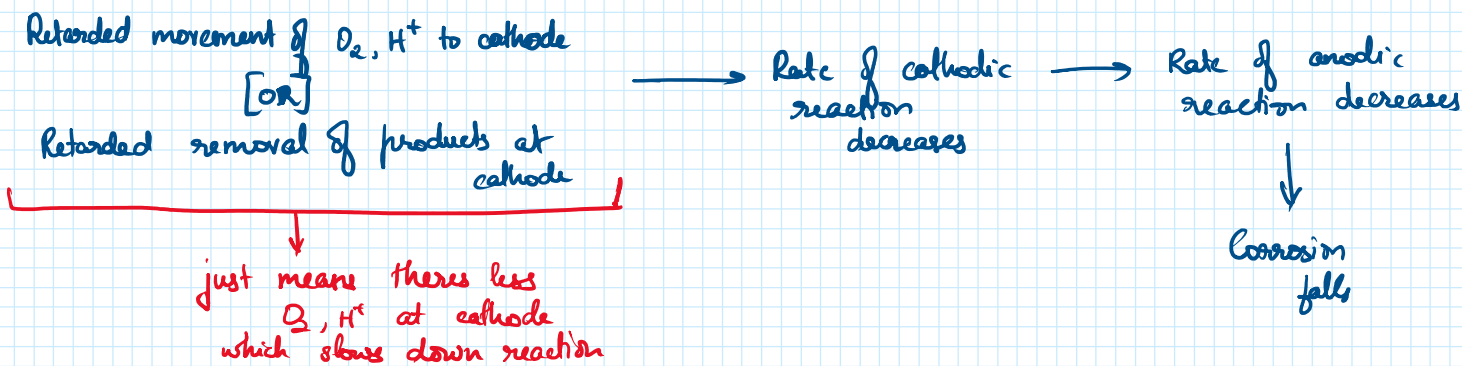
Drift in electrode potential due to change in concentration of species

Anodic polarisation



- Due to accumulation of ions in anodic region

Cathodic polarisation



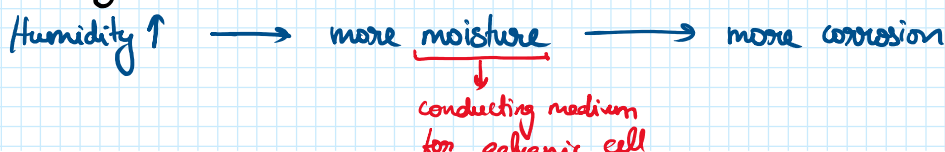
Reduction of polarisation:

- Using depolarisers
 - Anodic: complexing agents
 - Cathodic: cupric ions
- Increase in temperature
- Stirring the soln.

Electrical conductivity of corrosion medium

- Electrical conductivity $\uparrow \longrightarrow$ Faster ion migration \longrightarrow Faster exchange of $e^- \longrightarrow$ Higher corrosion
- Corrosion is more in saline water due to this

Humidity



↓
conducting medium
for galvanic cell
formation