7. Factors affecting rate of corrosion (cont.)

30 October 2023 17:09

Ratio of anodic to cathodic area

Large cathodic region → e^- liberated by anode consumed rapidly → e^- demand high → 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 → Evolution of gas is less
- Depends on surface

Hydrogen evolution → cathodic reaction

Cathodic reaction becomes faster → Anodic reaction becomes faster → Corrosion rate increases.

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

↑ Hydrogen overvoltage → rate of corrosion ↓

Temperature

For corrosion (redox reaction),

↑ Temp = ↑ Corrosion

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

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

↑ Temp = ↓ Solubility of gas = ↓ Corrosion

pH

Lower pH of corrosive medium = higher corrosive rate

low pH → high concentration of H^+ → 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

Metal is oxidised → released metal ions cannot move freely to cathode → Metal ions (M^+) get concentrated at anode → Decreases tendency for oxidation → Corrosion falls

- Due to accumulation of ions in anodic region

Cathodic polarisation

Retarded movement of O_2, H^+ to cathode
[OR]
Retarded removal of products at cathode

→ Rate of cathodic reaction decreases → Rate of anodic reaction decreases → Corrosion falls

just means theres less O_2, H^+ at cathode which slows down reaction

Reduction of polarisation:

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

Electrical conductivity of corrosion medium

Electrical conductivity ↑ → Faster ion migration → Faster exchange of e^- → Higher corrosion

- Corrosion is more in saline water due to this

Humidity

Humidity ↑ → more moisture → more corrosion

moisture → conducting medium for galvanic cell

conducting medium for galvanic cell formation