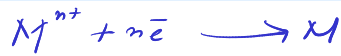


Important things in Electroplating

Concentration Polarisation

① Cathode

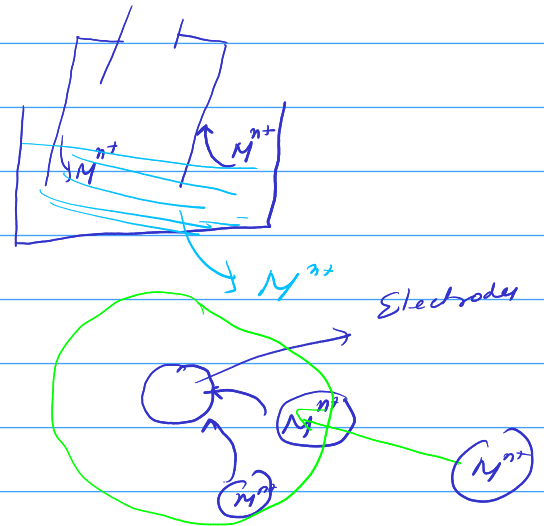


Diffusion rate $>$ deposition rate

\rightarrow Smooth plating happens

Diffusion rate $<$ deposition rate

\rightarrow Concentration of M^{n+} around the electrode becomes less relative to Bulk Concentration



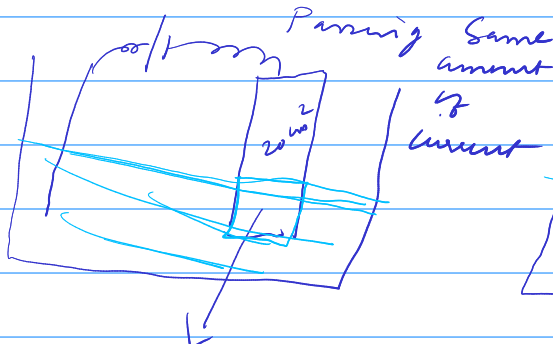
effect of Concentration polarisation:-

\rightarrow we may need to apply larger potential to have continuous electroplating

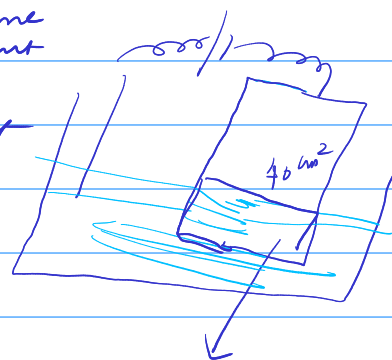
\rightarrow in case of galvanic \rightarrow Cell out put will be less than the theoretical value

How to overcome:-

\rightarrow increase the Surface area of electrode:-



deposition rate @ 100 g/hr



deposition rate @ 100 g/hr

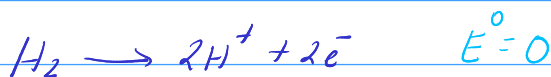
\rightarrow Temperature:- M^{n+} gains kinetic energy
 \therefore diffusion rate increases

\rightarrow Supporting electrolyte:-
diffusion rate increases

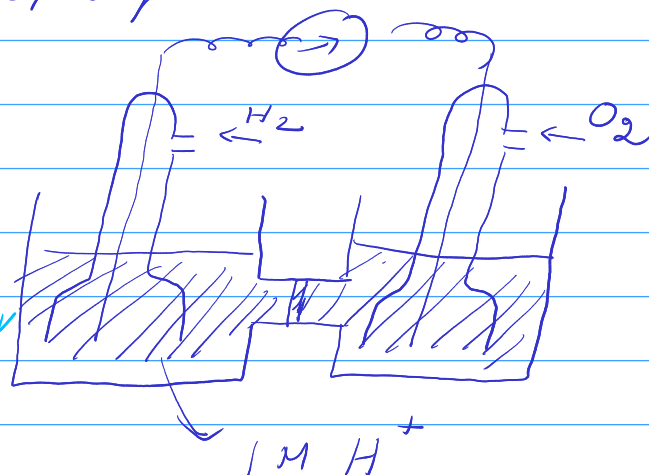
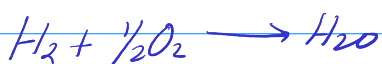
Decomposition potential:-

→ minimum potential required for continuous electrolysis / deposition

@ anode



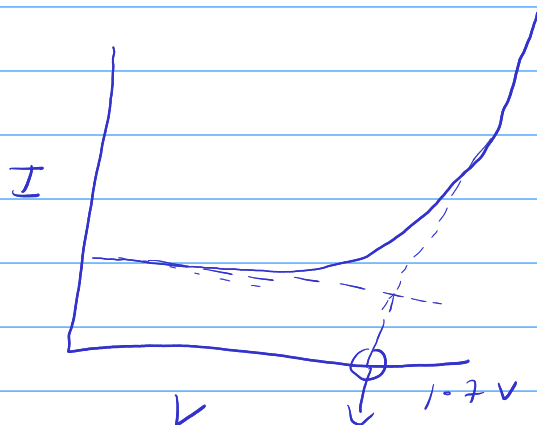
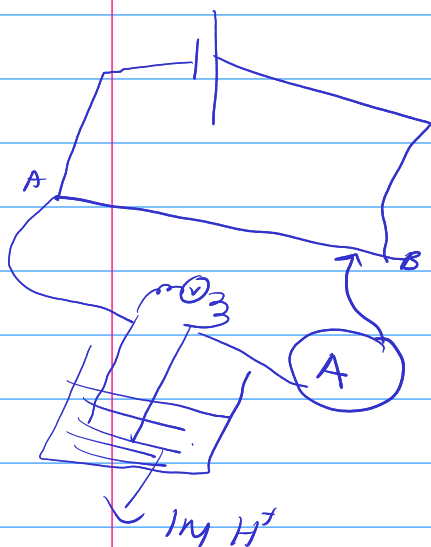
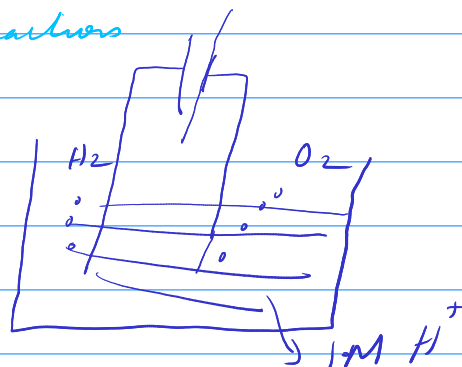
@ Cathode



$$E_{\text{cell}} = E_{\text{cath}} - E_{\text{anod}} = 1.23\text{V} - 0 = 1.23\text{V} \rightarrow +ve$$

if I want to reverse the reactions

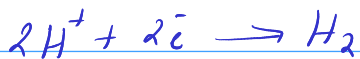
minimum I have to apply
1.23



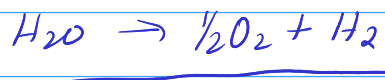
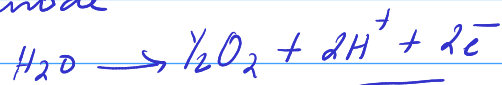
E_0 (decomposition potential)

→ decomposition potential is a minimum potential required for continuous electrolysis.

@ Cathode



@ anode



When we apply 1.23 V

→ H_2 & O_2 get absorbed on electrode surface and forms a Secondary cell. → Galvanic cell

Creates $1.23V$
↓
back emf.

→ So potential required for continuous electrolysis larger than theoretical value

$$\text{Over potential} = \text{Decomposition potential} - \text{theoretical Value}$$

$$= 1.7V - 1.23V$$

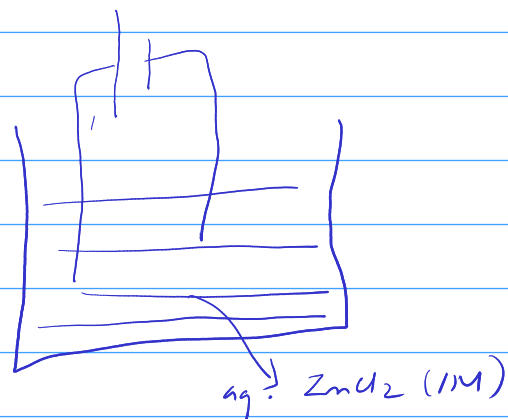
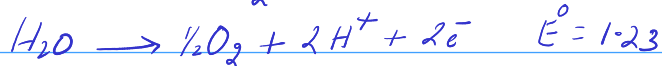
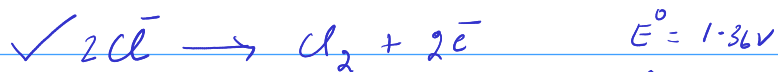
$$= 0.47 \text{ V}$$

→ Overpotential is potential we apply more than what is predicted as theoretical value for continuous electrolysis.

Overpotential is due to \Rightarrow Ohmic Potential
 $\{ \text{Cell internal resistance} \}$
 $+$
 Concentration polarization
 $+$
 back emf.

Effect of Overpotential

@ anode



@ Cathode



@ anode

→ Electrolysis of H_2O will not happen because

$E^\circ = 1.7$ { including Overpotential }

→ Oxidation of Cl^- ions is more preferred

@ Cathode:-

→ Reduction of H_2O $E^\circ = -1.33\text{V}$ { including Overpotential }

→ Reduction of Zn is preferred

Conclusion:-

Anode

Cathode

{ Any metal having $E^\circ > -1.33\text{V}$ can be reduced }

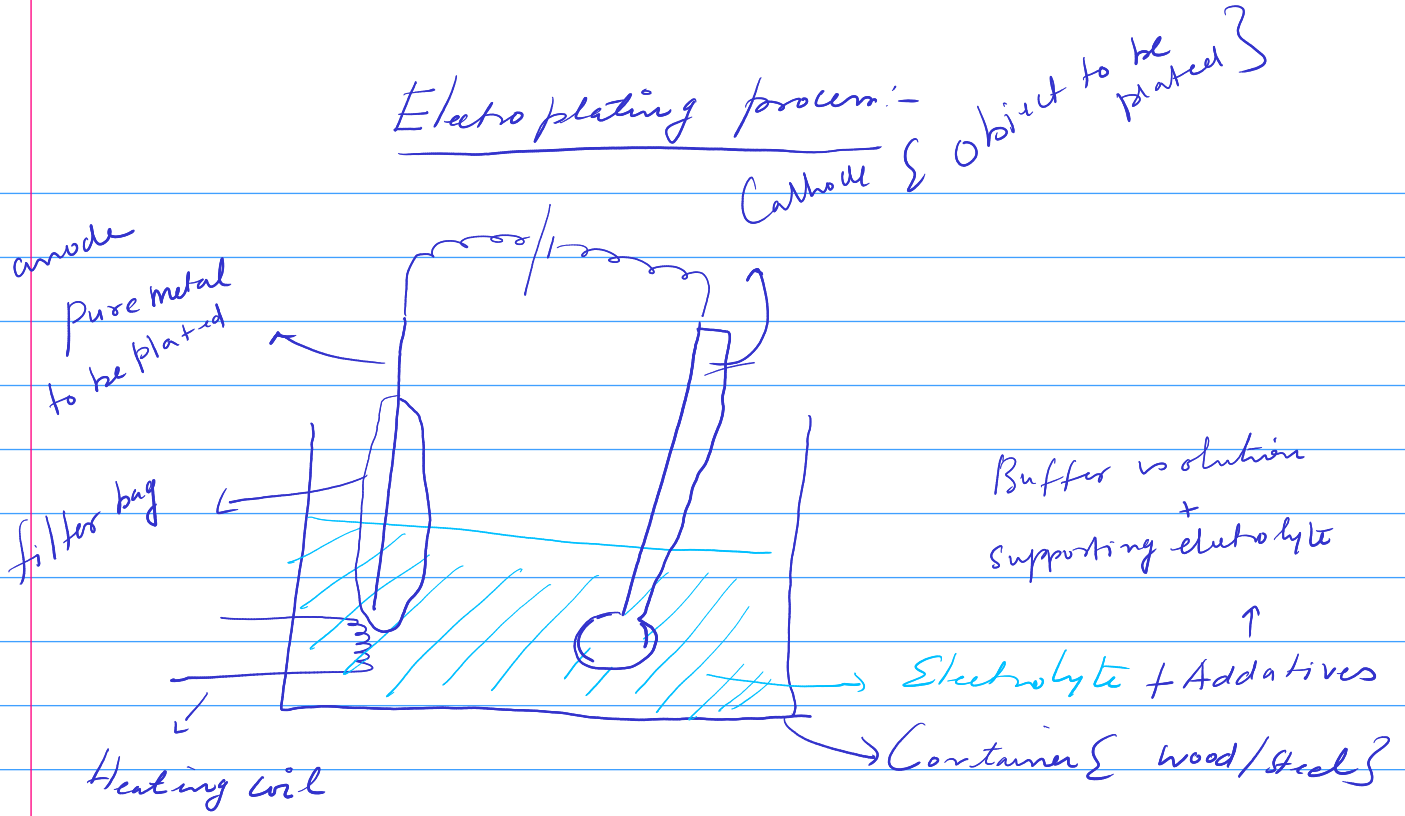
{ -1.33V }

Electroplating
in Aq. medium

{ 1.7V }

any species having $E^\circ < 1.7\text{V}$ can be oxidized in Aq. medium

Electroplating process:-



Heating coil:-

plating is done @ elevated temp to overcome Concentration polarization
 $\rightarrow 308 - 340 \text{ K}$ { most common }
 temperature range

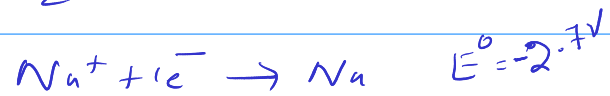
Electrolyte

- \rightarrow Aq. Salt of Metal to be plated
- \rightarrow high conductivity

Additives:-

1. Supporting electrolyte:- they help in conducting electricity in electrolyte

$\rightarrow \text{Na}_2\text{CO}_3$ { most common }



2. Buffer Solution:-

too Acidic medium \Rightarrow H_2 generations
 \downarrow
 H_2 gas try to escape \leftarrow H_2 get trapped @ Cathode

so plating is more brittle

→ too basic medium → leads to formation of metal oxides/metal hydroxides
affects the Quality of plating.

→ Commonly we use p^H 4-8 for plating

3. Wetting agent:-