



## Electrolytic cell

Conversion of electrical energy into chemical energy. The anode is positive plate and cathode is negative plate. Electrons are supplied to the cell from the external power supply. Non spontaneous reaction. Eg. Electroplating. The extent of chemical reaction occurring at the electrode is governed by Faraday's law of electrolysis. The amount of electricity passed during electrolysis is measured by Coulometer.

e.g: Electroplating, Electrolysis

## ELECTROPLATING OR ELECTRODEPOSITION

**Definition** Electroplating is the process by which the coating metal is deposited on the base metal by passing a direct current through an electrolytic solution containing the soluble salt of the coating metal.

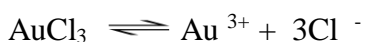
- The base metal to be plated is made cathode whereas the anode is either made of the coating metal itself or an inert material of good electrical conductivity (like graphite).

### Objectives:

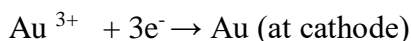
Electroplating is carried out for **1)** Decoration or better appearance **2)** Increasing the resistance to corrosion of the coated metal. **3)** Improving the hardness of the metal **4)** Increasing the resistance to chemical attack **5)** Electro refining.

### Theory:

E.g. if  $\text{AuCl}_3$  solution is used as an electrolyte it ionises as



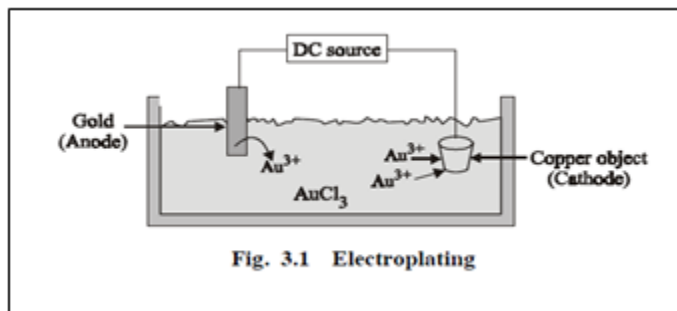
On passing current  $\text{Au}^{3+}$  ions go to the cathode and get deposited their



The free chloride ions migrate to the Au anode and dissolve an equivalent amount of Au to form  $\text{AuCl}_3$



The  $\text{AuCl}_3$  formed to get dissolved in the electrolyte. Thus there is a continuous replenishment of electrolyte during electrolysis.



### PROCESS:

- The article is to be plated first treated with organic solvent like carbon tetrachloride, acetone, tetrachloro ethylene to remove oils, greases etc.
- Then it is made free from surface scale, oxides, etc. by treating with dil. HCl or H<sub>2</sub>SO<sub>4</sub> (acid pickling).
- The cleaned article is then made as the cathode of the electrolytic cell.
- The anode is either the coating metal itself or an inert material of good electrical conductivity.
- The electrolyte is a solution of soluble salt of the coating metal.
- When direct current is passed, coating metal ions migrate to the cathode and get deposited there.
- Thus, a thin layer of coating metal is obtained on the article made as the cathode.
- In order to get strong, adherent and smooth deposit, certain types of additives (glue, gelatin, boric acid) are added to the electrolytic bath.
- In order to improve the brightness of the deposit, brightening agents are added in the electrolytic bath.

### The favourable conditions for a good electrodeposite are

- Optimum temperature
- Optimum current density
- Low metal ion concentrations.

### Gold Electroplating:

Anode: Gold

Cathode: Metal article

Electrolyte: Gold + KCN

Temperature: 60°C

Current density (mA/cm<sup>2</sup>): 1-10



**Use:**

- i) This is used for electrical and electronic applications.
- ii) It is used for high quality decorations and high oxidation resistant coatings
- iii) Usually for ornamental jewellery, a very thin gold coating (about  $1 \times 10^{-4}$  cm) is given.