

Experiment No07 : Electrochemical equivalent

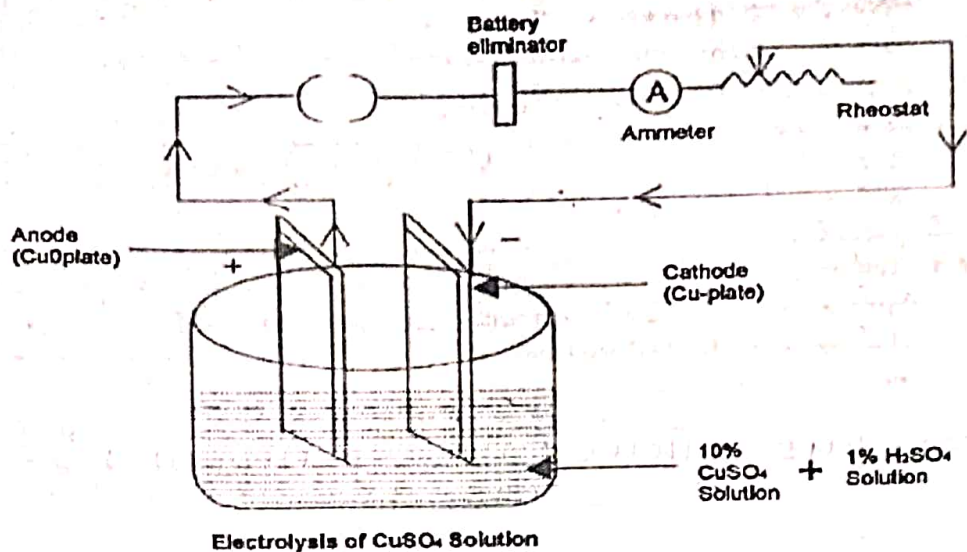
- I Practical Significance**

Diploma engineers have to work for electroplating coating and cladding of various metallic substances for different industrial applications. The determination of electrochemical equivalent using Faraday's first law is the key to lead the phenomenon of electroplating. It informs about the electrochemical equivalent of any metallic substance and highlights the electronic nature of the particular metal. This may help to take preventive measures in metallic corrosion and various applications in industries.
- II Relevant Program Outcomes**
 - PO1 Basic knowledge
 - PO3 Experiments and practice
- III Relevant Course Outcomes**
 - e) Apply corrosion preventive measures in industry.
- IV Practical Learning Outcome**

Determine electrochemical equivalent of Cu metal using Faraday's first law.
- V Practical Skills**
 1. Measurement skill
 2. Practical setup
- VI Relevant Affective domain related Outcomes**
 1. Demonstrate working as a leader/a team member.
 2. Maintain tools and equipment.
- VII Minimum Theoretical Background**

The key process of electrolysis is the interchange of atoms and ions by the removal or addition of electrons from the external circuit. The desired products of electrolysis are often in a different physical state from the electrolyte and can be removed by some physical processes. A liquid containing mobile ions (electrolyte) is produced by solution or reaction of an ionic compound with a solvent (such as water) to produce mobile ions or an ionic compound is fused by heating. An electrical potential is applied across a pair of electrodes immersed in the electrolyte.

VIII Experimental set-up



Electrolysis of CuSO_4 Solution

IX Resources required

Sr. No.	Resources	Specifications	Quantity	Remark
1	Copper plates	Given weight	20	
2	CuSO_4 solution	10 % concentration		
3	Glass beaker	1000 ml	20	
4	Battery	12 Volts		
5	Stop watch		10	
6	Chemical Balance	Scale range of 0.001g to 500gm pan size 100 mm; response time 3-5 sec.; power requirement 90- 250 V, 10 watt		
7	Polish paper			
8	Drier		01	
9	Copper wires			
10	Ammeter	0-2 amp		

X Procedure

1. Clean the copper cathode using polish paper, dilute HCl and then wash with water.
2. Dry it in oven or by using air drier.
3. Weigh the copper cathode.
4. Set up the apparatus as indicated in the diagram.
5. Connect the circuit as shown in figure.

6. Adjust the required current between 1 to 2 ampere and pass the current for 15/20 minutes.
7. Remove the cathode, wash with water gently and dry it using drier.
8. Weigh the copper cathode accurately.
9. Tabulate the observations.

XI Precautions

1. Clean the copper cathode.
2. Weigh the copper cathode accurately.
3. Connect the copper plates to positive and negative terminal of the battery

XII Actual procedure followed

Procedure followed in experiment no - 7

XIII Resources used (with major specifications)

Copper plates $CuSO_4$ glass beaker drive

XIV Precautions followed

1st weight the copper cathode according table

XV Observations and Calculations

Sr. No.	Observation	Symbol	Value
1	Wt. of Cu cathode before deposition	W_1	<u>180</u> gm
2	Wt. of Cu cathode after deposition	W_2	<u>160</u> gm
3	Wt. of Cu deposited	$W = W_2 - W_1$	<u>20</u> gm
4	Current in Ampere	C	<u>0.5</u> amp
5	Time in second	t	<u>20</u>sec

Calculations

$$Z = W / Ct$$
$$= \frac{W}{C \times t}$$
$$= \dots\dots\dots 2 \dots\dots\dots \text{gm/C}$$

XVI Results

Electrochemical equivalent of Copper (ECE) = 2 gm/C

XVII Interpretation of results

As the time increases, the weight of substance deposited on cathode increases.

XVIII Conclusions and Recommendations

The weight of substance liberated or deposited on electrode is directly proportional to the quantity of electricity passed through it.

XIX Practical Related Questions:

1. State the relation between chemical equivalent and electrochemical equivalent.
2. What will be the effect of increasing time for which current is passed on the amount of substance depositing?
3. Which type of electrode does copper anode forms?

XX References / Suggestions for further Reading

Sr. No.	Title of Book	Author	Publication
1	Experiments and calculations in engineering chemistry	Dr. S.S.Dara	S.Chand. Publication, New Delhi, 2011, ISBN: 8121908647
2	An Introduction To Electrochemistry	Samuel Glasstone	Maurice press, London, ISBN : 9781406717792
3	Engineering Chemistry	A.D. Sharma, V. Thakur	Wiley International N. J.,2012, ISBN: 9788126537419

XXI Assessment Scheme

Process related assessment scheme

Sr. No.	Process related	Weightage (60%)
1	Process for removal of cathode from solution	20%
2	Process for drying of cathode	20%
3	Weighing of Copper cathode	10%
4	Cleaning of Copper cathode	10%

Product related assessment scheme		Weightage(40%)
Sr. No.	Product related	40%
1.	Electrochemical equivalent of Copper	

List of Student Team Members

1.
2.
3.
4.

Marks Obtained			Dated Signature of Teacher
Process Related (15)	Product Related (10)	Total (25)	
14	09	23	<i>[Signature]</i>

[Space to Write Answers]

Q1 — ?

Electrical equivalent of a substance is the simple ratio of chemical equivalent to weight faraday.

$$e_{ce} = \frac{e}{f}, \quad e = \text{chemical}$$

equipment weight f = faraday number

Q2 — ?

If we increase the time for current then more deposition is carried out that is weight of Cu is in 106's.

Q3 — ?

The copper metal is formed at the negative electrode oxygen gas is formed at the positive electrode.

End