

## 7. ELECTROCHEMISTRY

### 1. ELECTROCHEMISTRY

Electrochemistry is the study of production of electricity from the energy released during a spontaneous chemical reaction and the use of electrical energy to bring about non-spontaneous chemical transformations.

### 2. ELECTROCHEMICAL CELLS

A spontaneous chemical process is the one which can take place on its own and in such a process the Gibbs's energy of the system decreases. It is this energy that gets converted to electrical energy. The reverse process is also possible in which we can make non-spontaneous processes occur by supplying external energy in the form of electrical energy. These inter conversions are carried out in equipments called Electrochemical Cells.

### 3. TYPES

Electrochemical Cells are of two types:

#### 3.1 Galvanic Cells

Converts chemical energy into electrical energy

#### 3.2 Electrolytic Cells

Converts electrical energy into chemical energy.

### 4. GALVANIC CELL

Cell energy is extracted from a spontaneous chemical process or reaction and it is converted to electric current. For example, Daniell Cell is a Galvanic Cell in which Zinc and Copper are used for the redox reaction to take place.



Zn is the reducing agent and  $\text{Cu}^{2+}$  is the oxidising agent. The half cells are also known as **Electrodes**. The oxidation half is known as **Anode** and the reduction half is called **Cathode**. Electrons flow from anode to cathode in

the external circuit. Anode is assigned **negative polarity** and cathode is assigned **positive polarity**. In Daniell Cell, Zn acts as the anode and Cu acts as the cathode.

### 5. ELECTROLYTIC CELL

These electrodes are dipped in an electrolytic solution containing cations and anions. On supplying current the ions move towards electrodes of opposite polarity and simultaneous reduction and oxidation takes place.

#### 5.1 Preferential Discharge of ions

Where there are more than one cation or anion the process of discharge becomes competitive in nature. Discharge of any ion requires energy and in case of several ions being present the discharge of that ion will take place first which requires the energy.

### 6. ELECTRODE POTENTIAL

It may be defined as the tendency of an element, when it is placed in contact with its own ions to either lose or gain electrons and in turn become positively or negatively charged.

The electrode potential will be named as oxidation or reduction potential depending upon whether oxidation or reduction has taken place.



#### 6.1 Characteristics

- Both oxidation and reduction potentials are equal in magnitude but opposite in sign.
- It is not a thermodynamic property, so values of E are not additive.

### 7. STANDARD ELECTRODE POTENTIAL ( $E^{\ominus}$ )

It may be defined as the electrode potential of an electrode determined relative to standard hydrogen electrode under standard conditions. The standard conditions taken are :

# Electrochemistry Notes For Engineering

**LM Reder**



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