ELECTROANALYTICAL TECHNIQUES

Lecture 1

By

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Electroanalytical techniques, what's the use

- Group of methods:
- Based on electrical properties of analyte solution when made a part of electrochemical cell
- These techniques study an analyte by measuring potential and/or current in an electrochemical cell

Types of Electroanalytical techniques

- Electrogravimetry
- Coulometry
- Potentiometry
- Voltammetry

Types of Electroanalytical techniques

Electrogravimetry

Analyte electrolytically deposited upon electrode

Weighed at electrode

Coulometry:

Analyte determined by quantitative reaction during electrolysis

Potentiometry:

Analyte determined by measuring electrode potential of ions compared to reference

Voltammetry:

Analyte determined by measuring current that is related to conc of analyte by application of potential

Types of Electroanalytical techniques

Electrogravimetry

Analyte electrolytically deposited upon electrode

Weighed at electrode

Let's define some basic terms

- SI unit for measuring current is "Ampere"
  - Unit to measure electric current
  - Electric current is basically flow of charges (ions, electrons or both)
- Coulomb:
  - Quantity of current passing when current of 1 A flows for 1 sec
- Volt:
  - Unit of potential difference
  - Force that moves electrons through a circuit
- Current Density : Current flowing per unit Area (A/m^2)

Electrogravimetry, let's go to basics

- Two major laws that we need to know
- Ohm's Law:
  - Current proportional to applied voltage [I = V/R]
- Faraday's Law of electrolysis:

Understanding Electrolysis

- Electrolysis is a method of using a direct electric current (DC) to drive an otherwise non-spontaneous chemical reaction
- Electrolysis is the passage of a direct electric current through an ionic substance that is either molten or dissolved in a suitable solvent, resulting in chemical reactions at the electrodes
- Three main components of electrolysis
    1. An electrolyte : a substance containing free ions which are the carriers of electric current in the electrolyte. If the ions are not mobile, as in a solid salt then electrolysis cannot occur
    2. A direct current (DC) supply : provides the energy necessary to create or discharge the ions in the electrolyte. Electric current is carried by electrons in the external circuit
    3. Two electrodes : an electrical conductor which provides the physical interface between the electrical circuit providing the energy and the electrolyte

Electrogravimetry, let's go to basics

- Faraday's Law of electrolysis:
  1. Amount of substance dissolved or liberated proportional to quantity of electricity passing through solution
  2. Amount of different substance dissolved or liberated by same quantity of electricity are proportional to their relative atomic masses/number of electrons involved in respective electrode process

Summary & What's Next

- Defined different types of electroanalytical techniques
- Introduced electrogravimetry
- Fundamental laws defining electrogravimetry
- What's Next
  - Define various terminology
  - Review apparatus
  - Characteristics/factors affecting deposition
  - Applications in brief