Thermo Gravimetric Analysis (TGA)

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What are Thermal Methods?
Thermal Methods

Heat

Change in Physical Property

Applied Thermal analysis techniques
Thermal Methods...

Thermal methods of analysis, comprises of group of analytical techniques in which changes in physical or chemical properties of a substance are measured as a function of temperature.
Types of Thermal Methods

- TGA
- DTA
- DSC
- EGA
TGA

Thermo gravimetric analysis (TGA) is a technique in which a change in weight of a substance is measured as a function of temperature.
Differential thermal analysis is a technique in which the temperature difference between a substance and a reference material is measured as a function of temperature.
DSC

Differential scanning calorimetry is a technique in which a change in heat energy between a substance and a reference material is measured as a function of temperature.
EGA

Evolved gas analysis, in which qualitative and quantitative evaluations of volatile products formed during thermal analysis of TGA or DTA or DSC interfaced with FTIR or MS.
What is TGA?
Principle of TGA:

**Principle of Thermo Gravimetry:**

Thermo Gravimetry (TG) or Thermo Gravimetric Analysis (TGA), is an analytical technique in which a change in the weight of a substance is recorded as a function of temperature.
Thermogram or TG Curve....

Thermo gravimetric analysis results are expressed in the form of, a thermogram or a thermo gravimetric curve, which is a plot of weight percentage Vs. temperature
Derivative thermo gravimetric (DTG) curve is the plot of first derivative of the TG curve vs. temperature. It is also known as a decomposition curve.
Thermogram
Different regions in TG Curve

Horizontal portions (Plateaus) indicate regions where there is no weight loss. Curved portions indicate regions of weight loss.
TG Curve - Regions

Mass Change: -12.28%

Mass Change: -18.06%

Mass Change: -29.22%

Residual Mass: 39.75% (995.5 °C)
Different types of TG Curves

(i). No Decomposition with loss of volatile products
(ii). Rapid initial mass loss characteristic of desorption or drying
(iii). Decomposition in single stage
(iv). Multi stage decomposition
(v). Multi stage decomposition but no stable intermediate
(vi). Gain in weight due to sample reaction
(vii). Reaction product decompose again.
Significance of TG Curve

The measured weight change in TG curve gives information about,

- Sample composition
- Thermal stability of the compound
- Material Characterization
Mechanism of weight change in TGA

Weight Loss due to,

- Decomposition
- Evaporation
- Reduction
- Desorption.
Mechanism of weight change in TGA

Weight Gain due to,

- Oxidation
- Absorption
- Adsorption
Thank You......