

Thermo Gravimetric Analysis (TGA)

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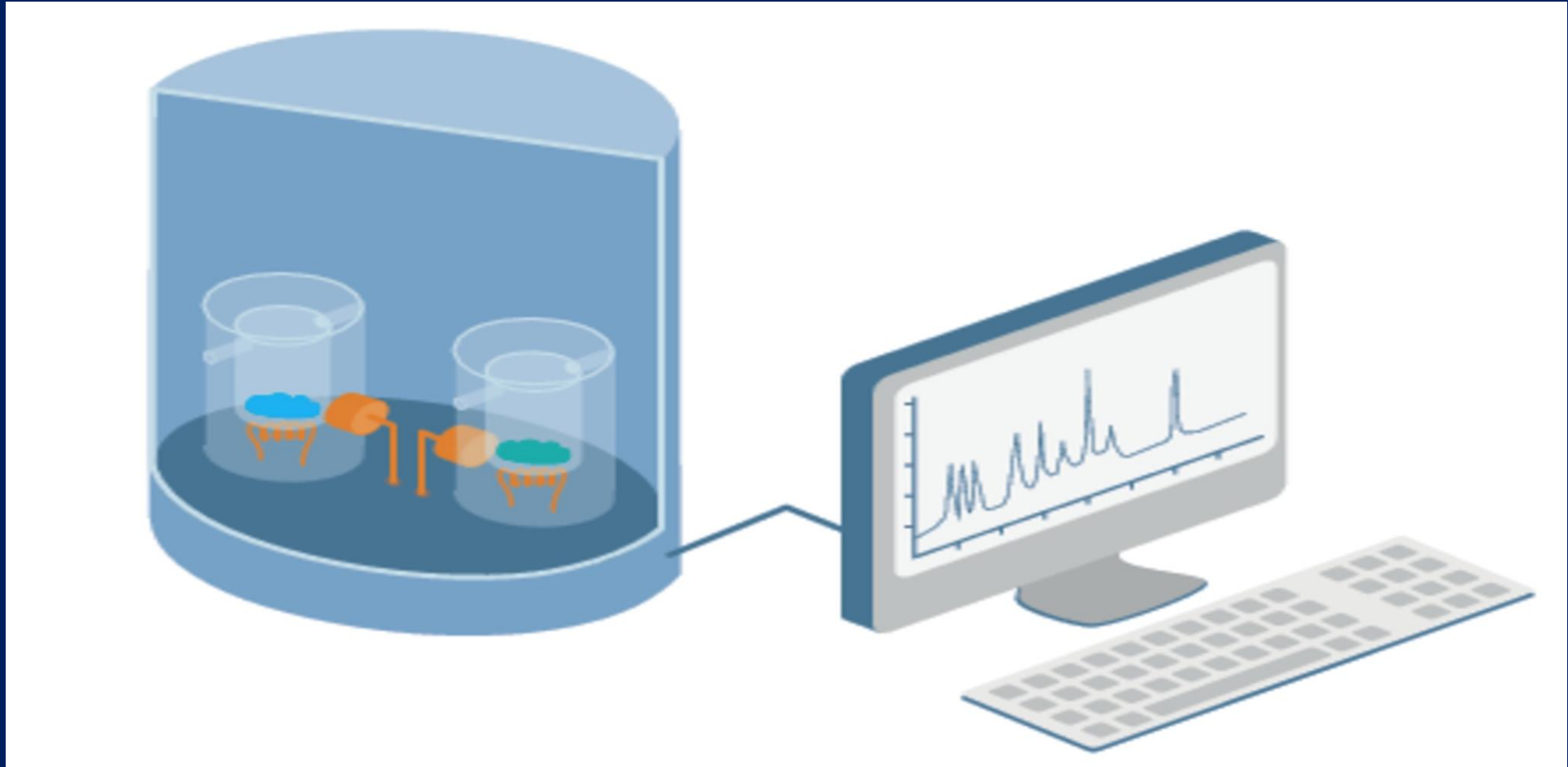
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KAKINADA

Contents...

- Thermal Methods introduction & Classification
- TGA, DTA, DSC & EGA - Definitions
- TGA Principle
- Thermogram & Different types of TG curves
- Mechanism of weight change in TGA

What are Thermal Methods ?



Thermal Methods

Heat

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graph TD; A[Heat] --> B[Change in Physical Property]; B --> C[Applied Thermal analysis techniques];
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The diagram is a vertical flowchart with three rectangular boxes. The top box is light blue with a white border and contains the word 'Heat' in red. A large, downward-pointing blue arrow connects the bottom of the first box to the top of the second box. The second box is a darker blue with a white border and contains the text 'Change in Physical Property' in yellow. Another large, downward-pointing blue arrow connects the bottom of the second box to the top of the third box. The third box is the same dark blue with a white border and contains the text 'Applied Thermal analysis techniques' in dark blue.

**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

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graph TD; A[Types of Thermal Methods] --> B[TGA]; A --> C[DTA]; A --> D[DSC]; A --> E[EGA];
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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.

DTA

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.

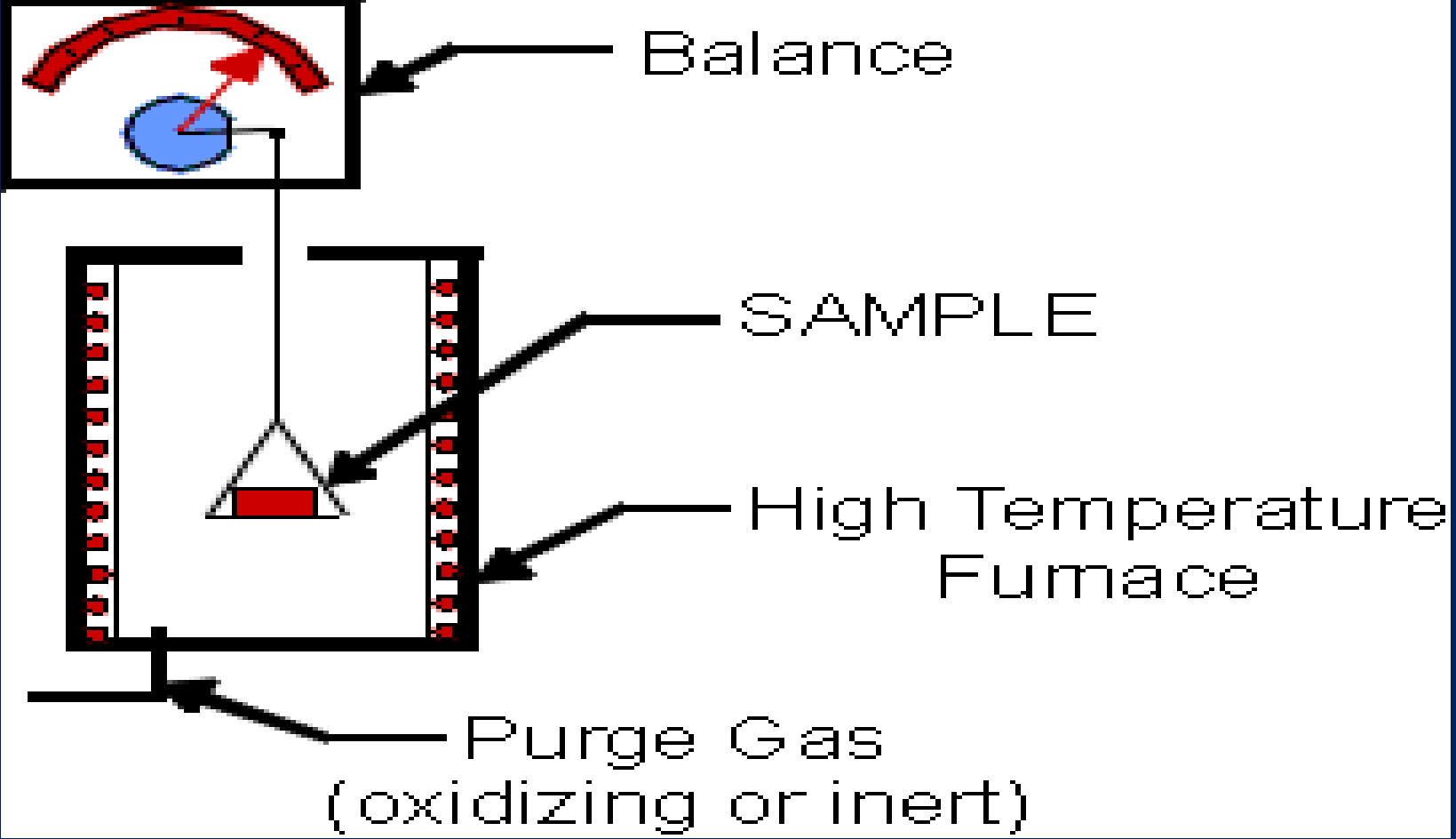
DSC

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.

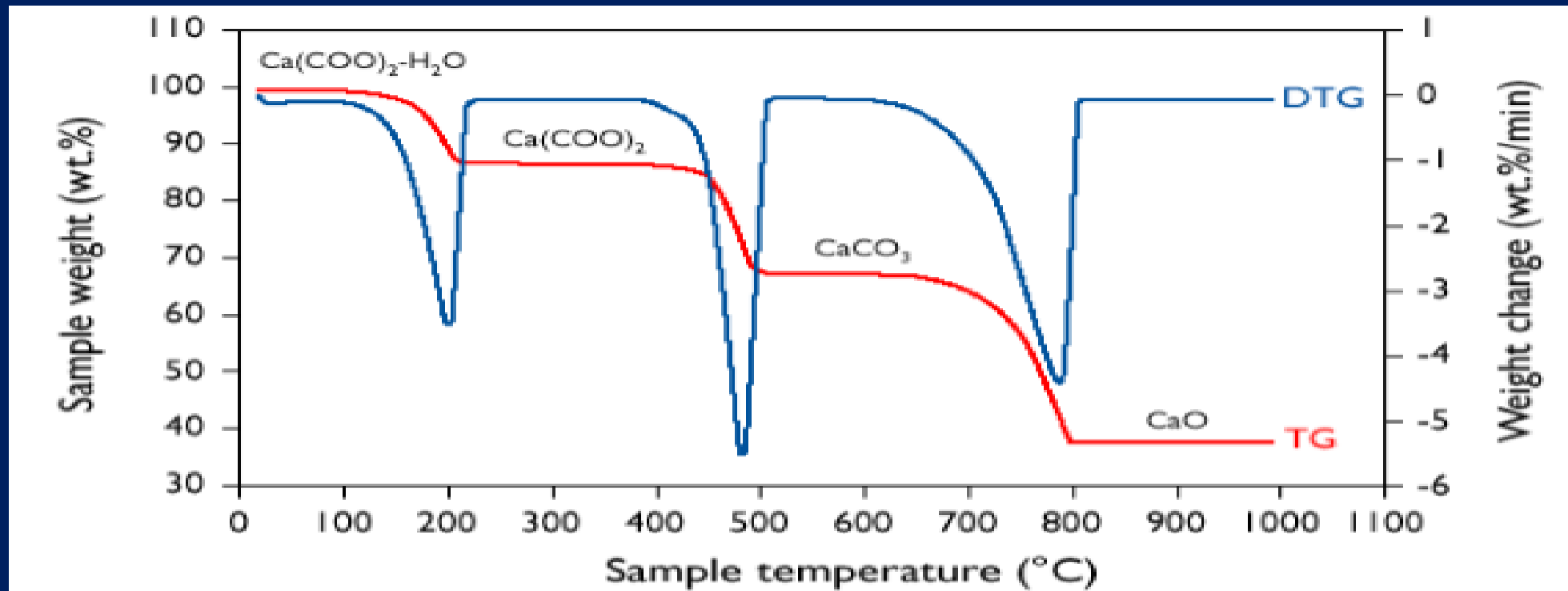
Thermogram or TG Curve....

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 TG Curve...

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

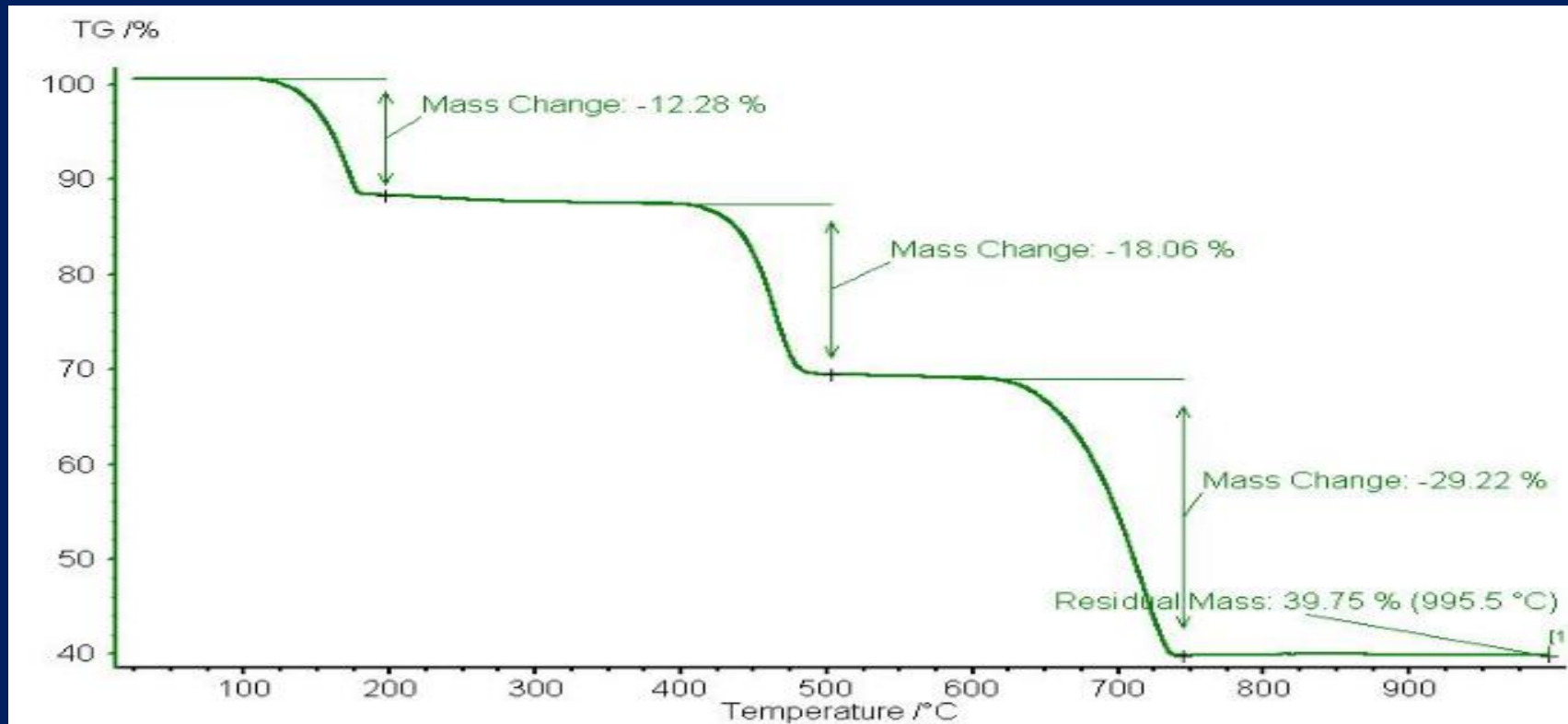


Different regions in TG Curve

Horizontal portions (Plateaus) indicate regions where there is no weight loss.

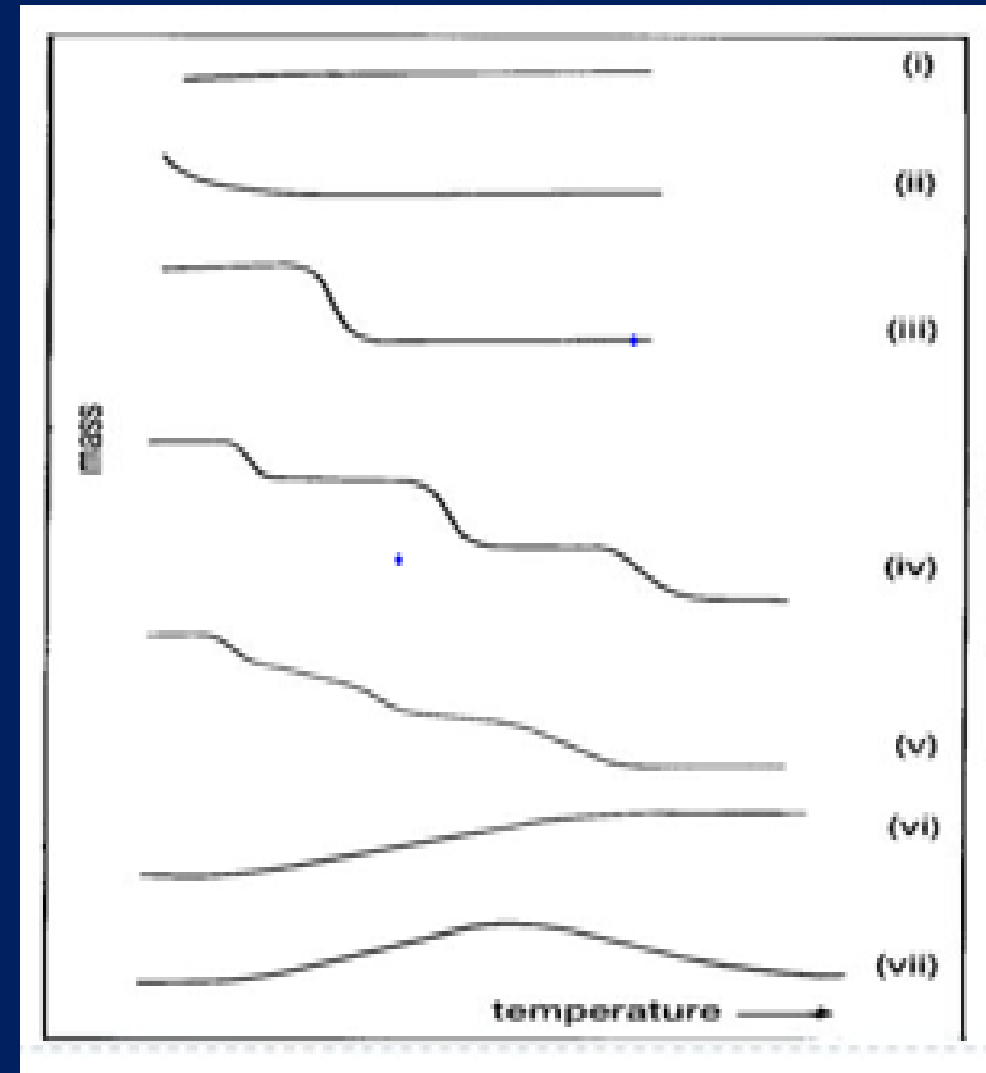
Curved portions indicate regions of weight loss.

TG Curve - Regions



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.....

