Thermo Gravimetric Analysis - Applications

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- TGA - Applications
- TGA curves of different compounds
- References

Applications of Thermogravimetry…

- To determine the composition of materials
- To predict thermal stability of materials
- Determination of purity of primary and secondary standards
- Automatic thermo gravimetric analysis
- Characterization of the materials

Applications of Thermogravimetry…

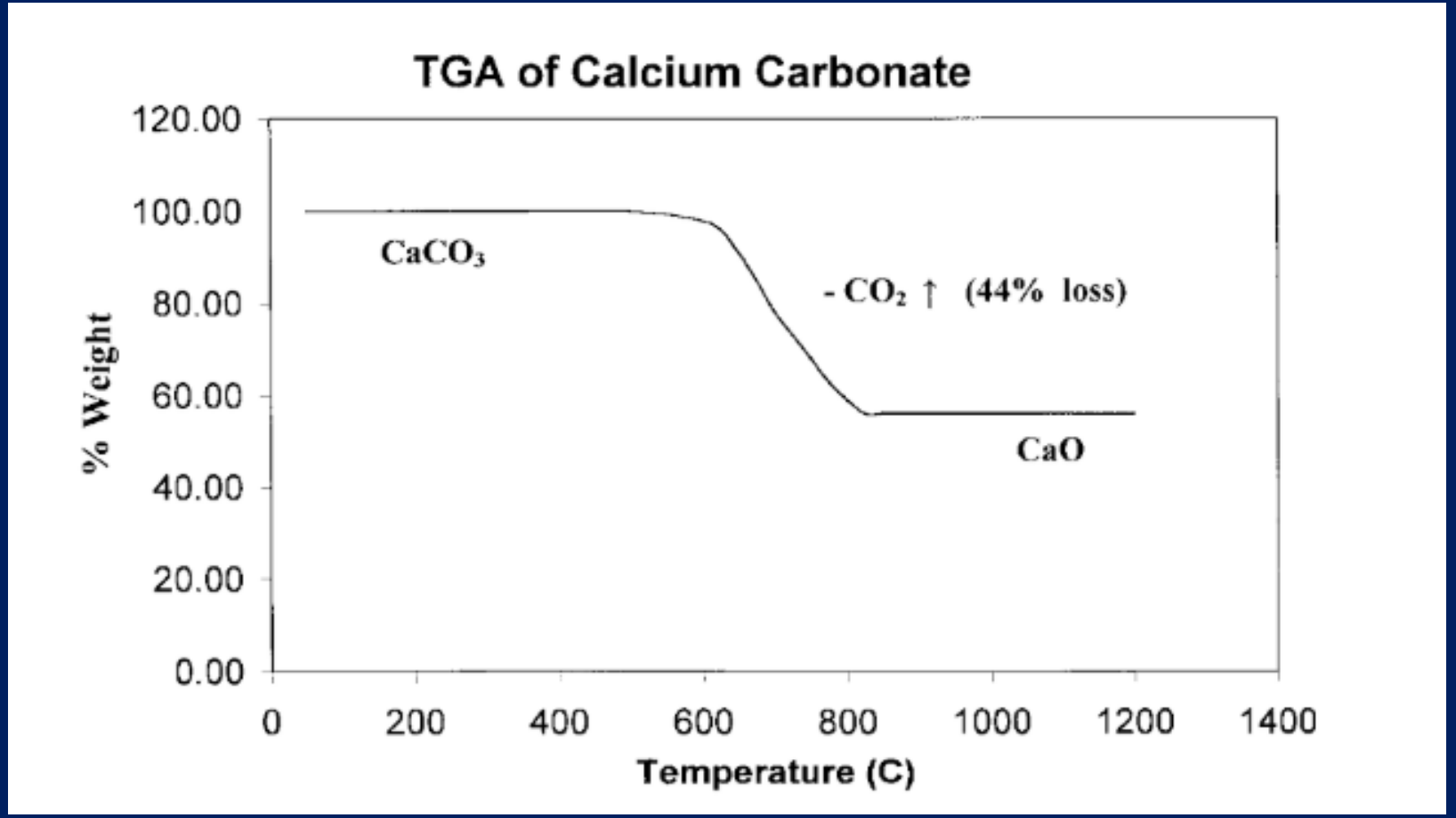
- Decomposition Kinetics of Materials
- Corrosion Studies of different materials
- Moisture and Volatile Contents of different materials
- Study of drying temperatures of gravimetric precipitates

Applications of TGA…

- Analysis of Copper sulphate penta hydrate
- Analysis of Calcium oxalate mono hydrate
- Automatic determination of a mixture of calcium and magnesium as their oxalates.
- Thermal stability of polymers
- Oxidative stability of polymers

TGA of Calcium Carbonate ($CaCO_3$)

TGA Curve of $CaCO_3$



TGA of Calcium Carbonate ($CaCO_3$)

Pure Calcium carbonate is heated to 850 ^oC, it loses 44% of its weight. Also, the gas evolved can be collected and identified as CO_2. This observation virtually confirms that the following reaction takes place at this temperature.

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2\ (g)\ ;\ 850^oC$$

Thermo gravimetric analysis of $CuSO_4.5H_2O$

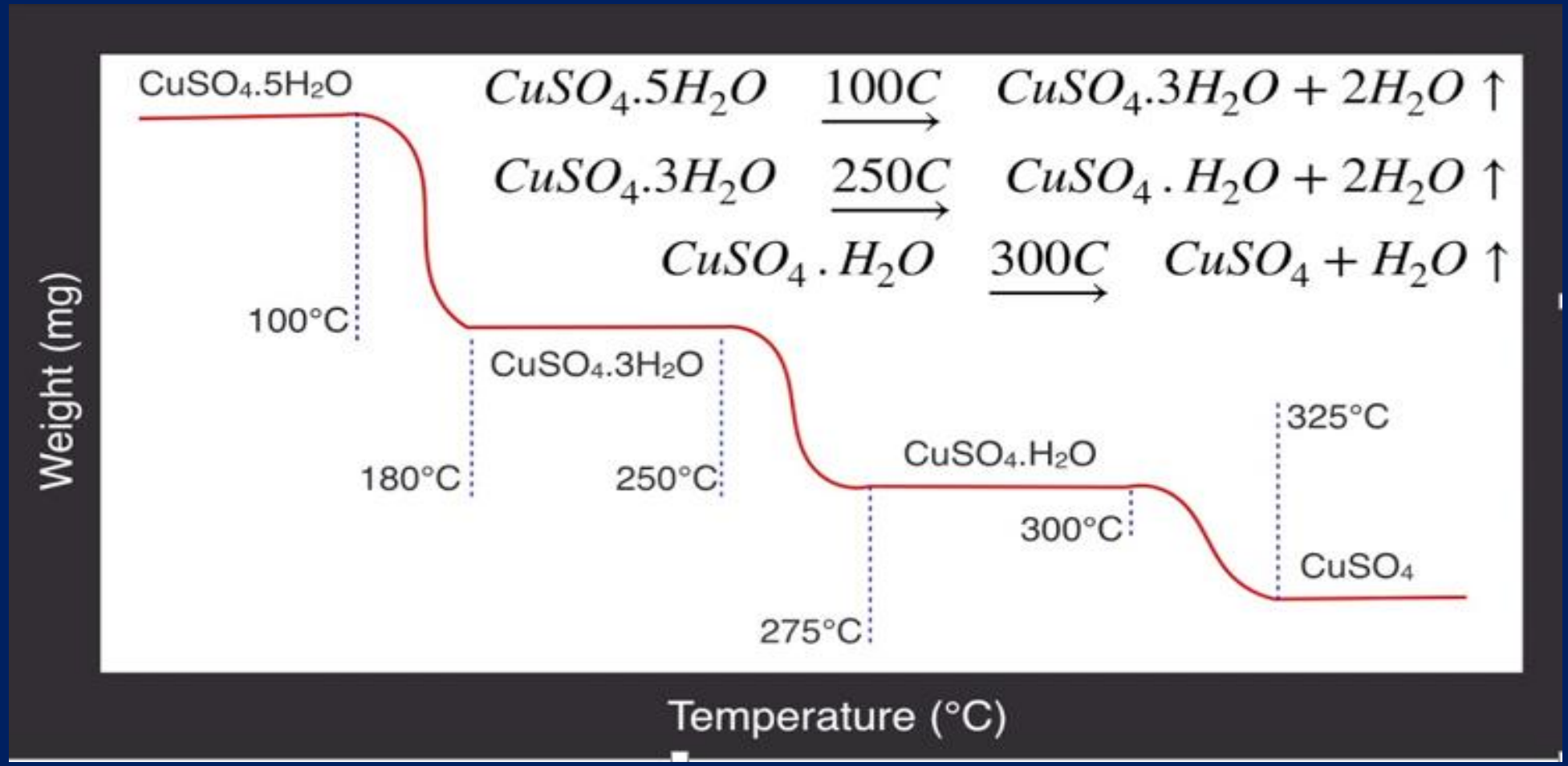
1. $CuSO_4.5H_2O \longrightarrow CuSO_4.H_2O$; 90 – 150 ^oC

2. $CuSO_4.H_2O \longrightarrow CuSO_4$; 200 - 275 ^oC

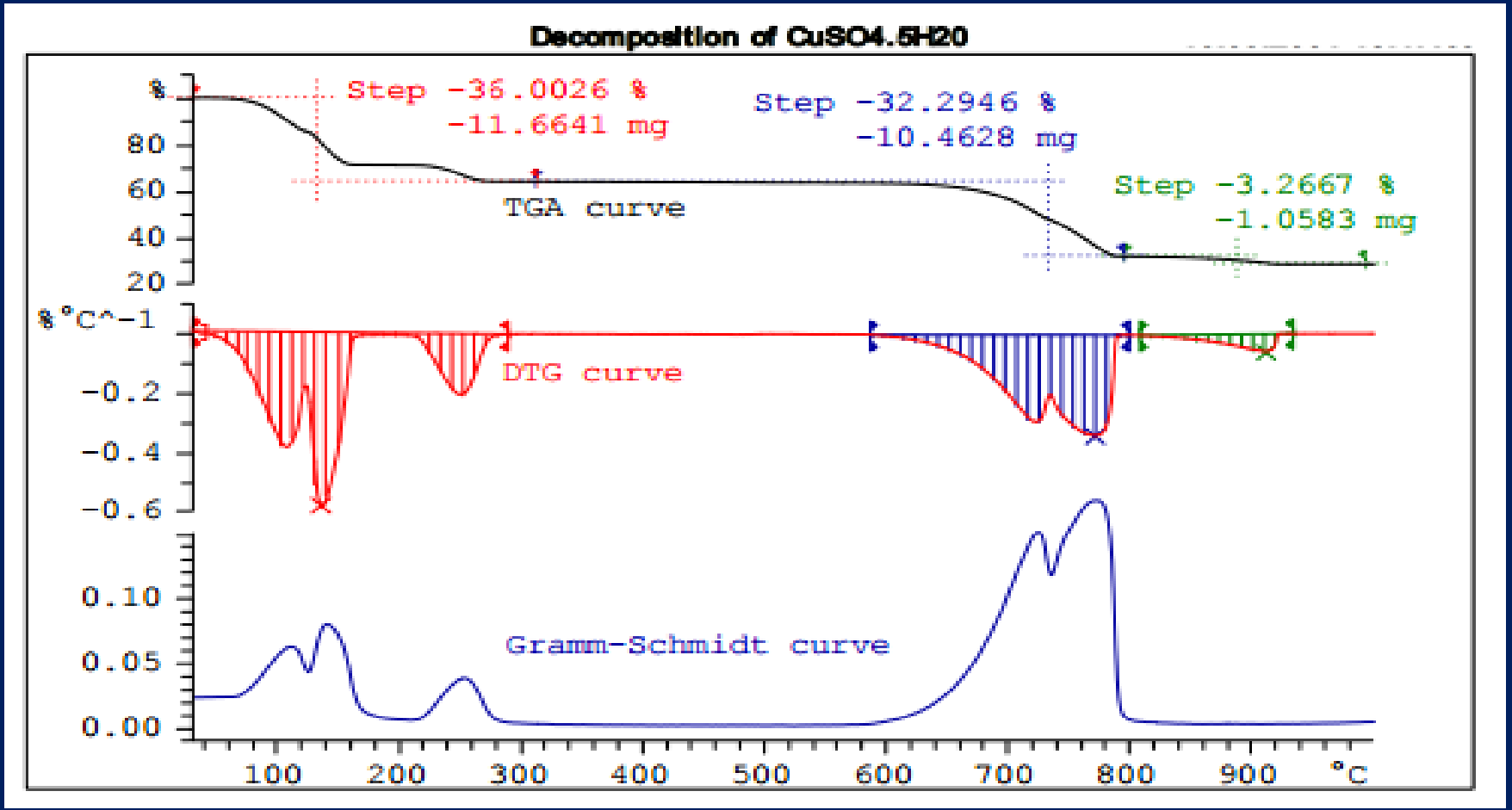
3. $CuSO_4 \longrightarrow CuO + SO_2 + ½\ O_2$; 700 - 900 ^oC

4. $2CuO \longrightarrow Cu_2O + ½\ O_2$; 1000 – 1100 ^oC

TG Curve of $CuSO_4.5H_2O$



DTG Curve of $CuSO_4.5H_2O$



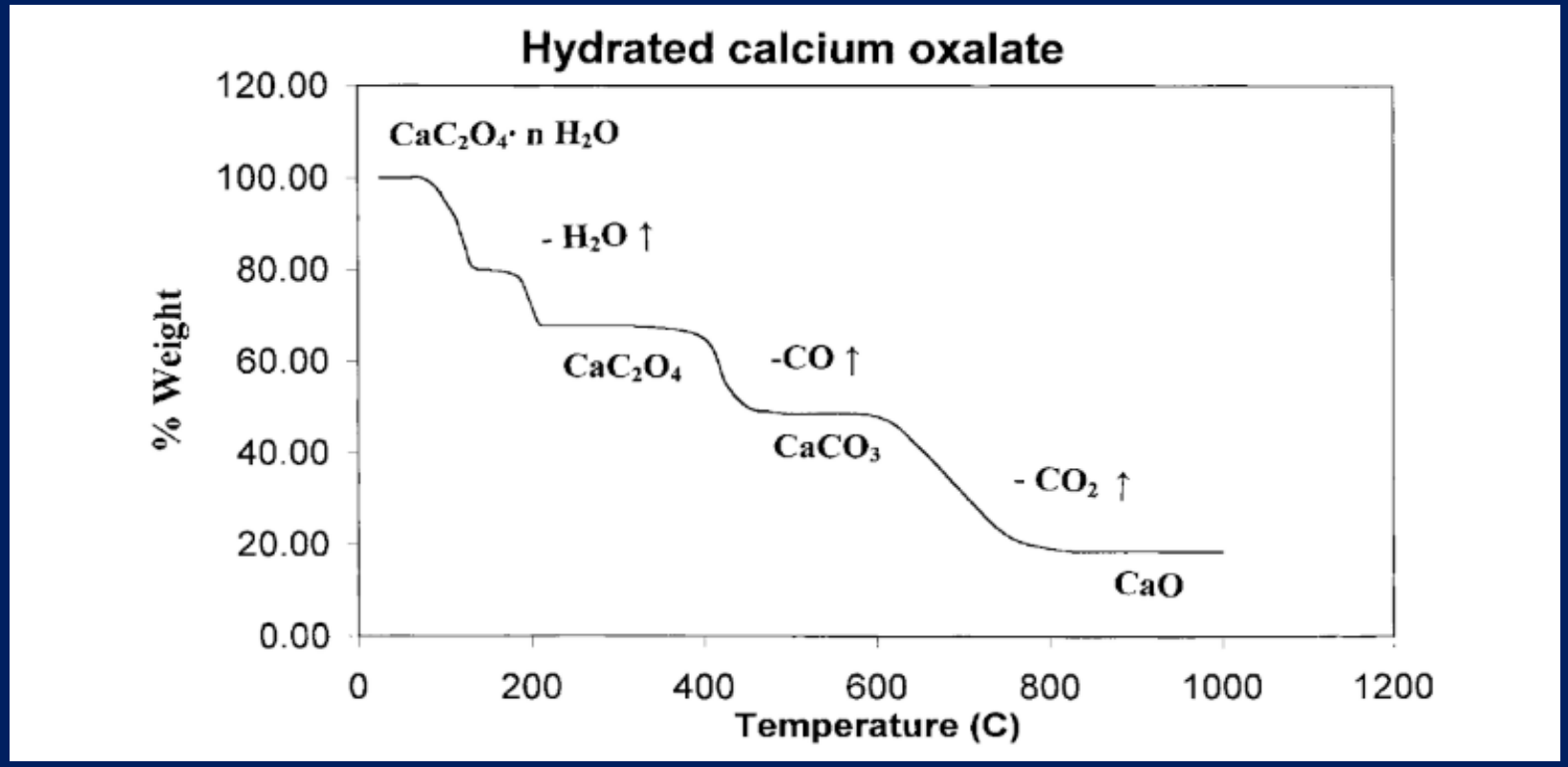
TGA: Calcium oxalate decomposition

Step: (i). $CaC_2O_4.H_2O(s) \rightarrow CaC_2O_4(s) + H_2O\ (g)$ 100 – 250 ^oC

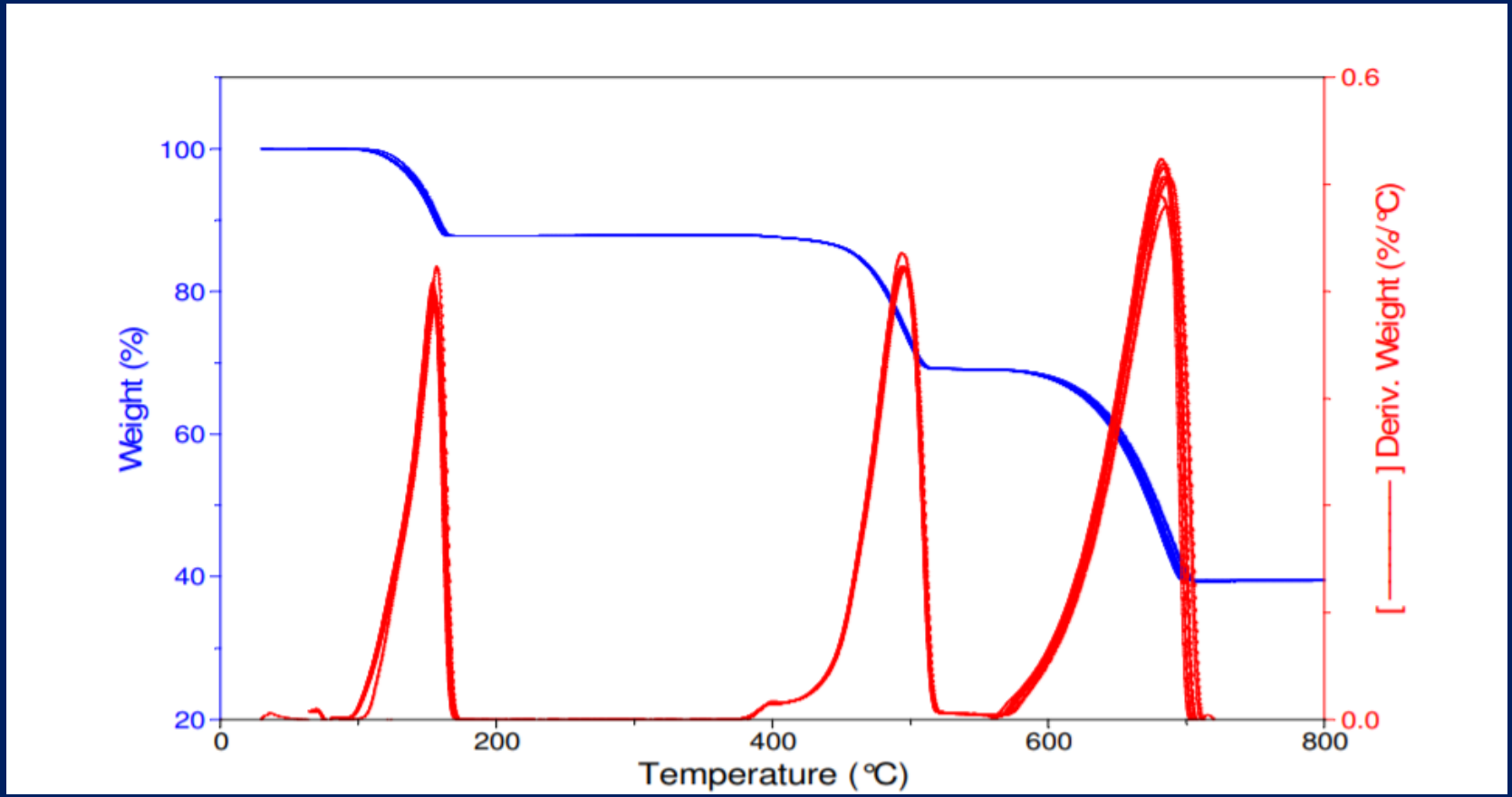
Step: (ii). $CaC_2O_4(s) \rightarrow CaCO_3(s) + CO\ (g)$ 400 – 500 ^oC

Step: (iii). $CaCO_3(s) \rightarrow CaO + CO_2\ (g)$; 650 – 850 ^oC

Thermogram of Calcium Oxalate monohydrate



Thermogram and DTG curve of Calcium Oxalate



Automatic determination of a mixture of Ca^{2+} and Mg^{2+}

Step: (a). $CaC_2O_4.H_2O(s) \longrightarrow CaC_2O_4(s) + H_2O\ (g)$; 100 – 250 ^oC

Step: (b). $CaC_2O_4(s) \longrightarrow CaCO_3(s) + CO\ (g)$; 400 – 500 ^oC

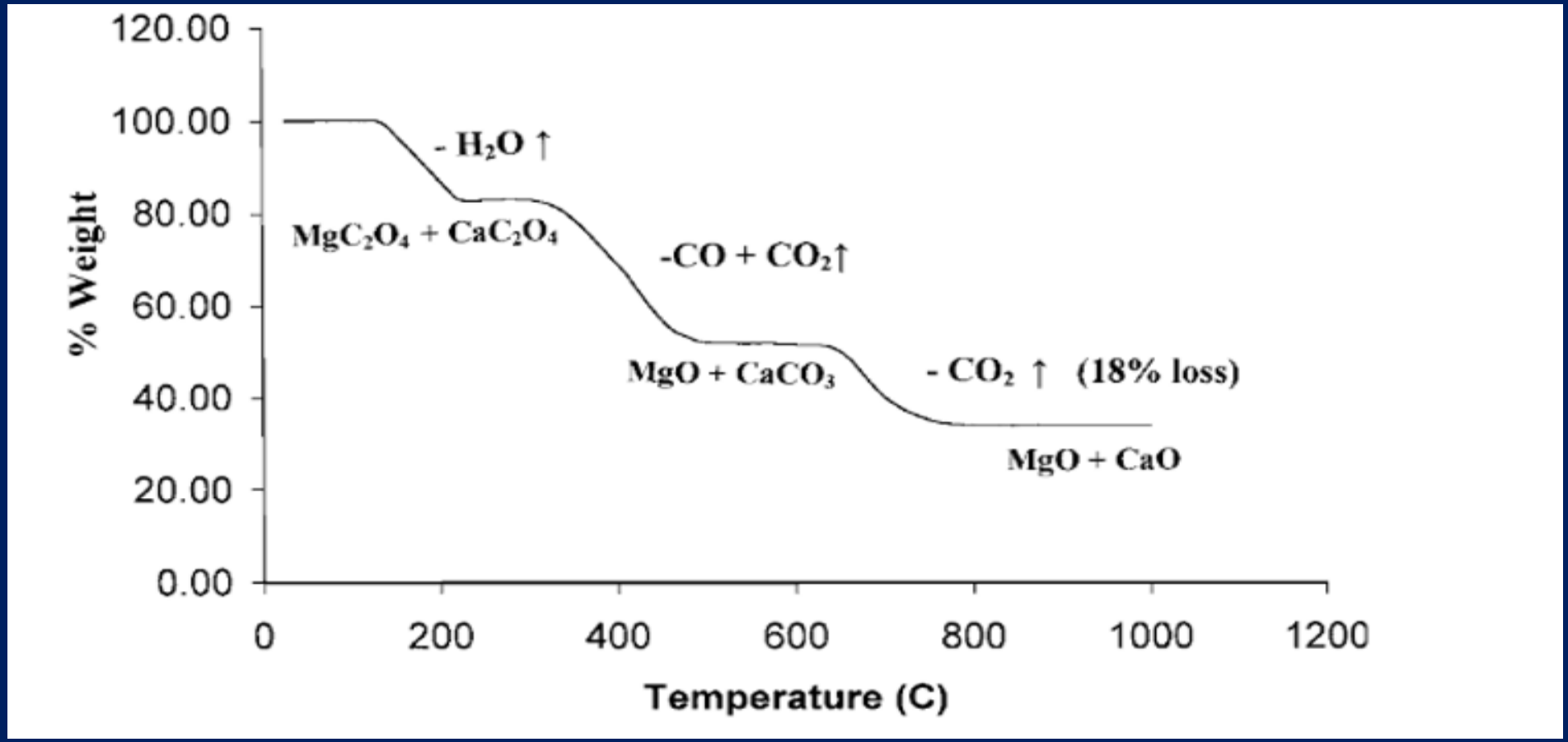
Step: (c). $CaCO_3(s) \longrightarrow CaO + CO_2\ (g)$; 650 – 850 ^oC

Automatic determination of a mixture of Ca & Ma as their oxalates

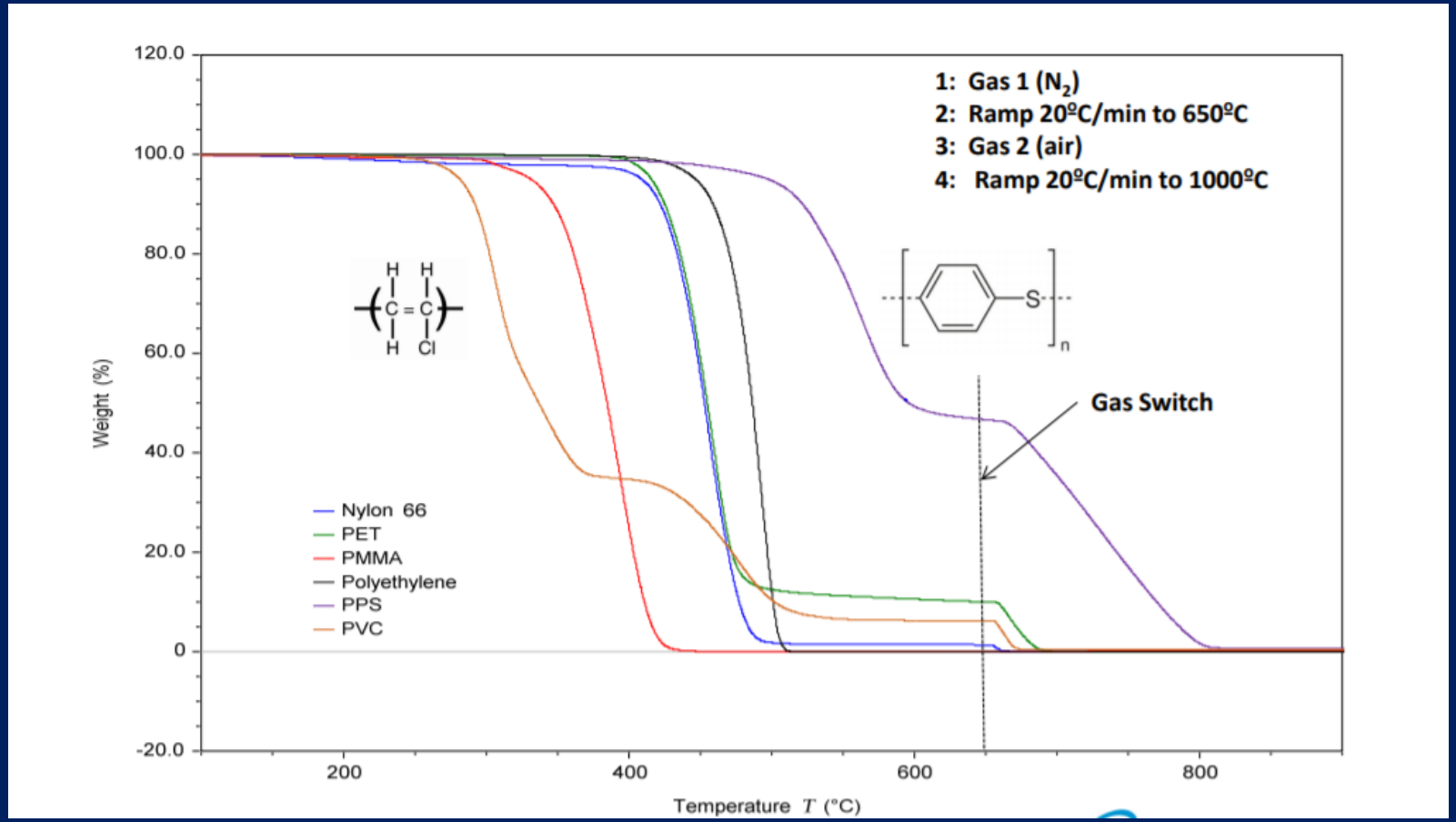
Step: (d). $MgC_2O_4.2H_2O(s) \xrightarrow[100 - 250\ ^oC]{} MgC_2O_4(s) + 2H_2O\ (g)$;

Step: (e). $MgC_2O_4(s) \xrightarrow[400 - 500\ ^oC]{} MgO\ (s) + CO\ (g) + CO_2\ (g)$;

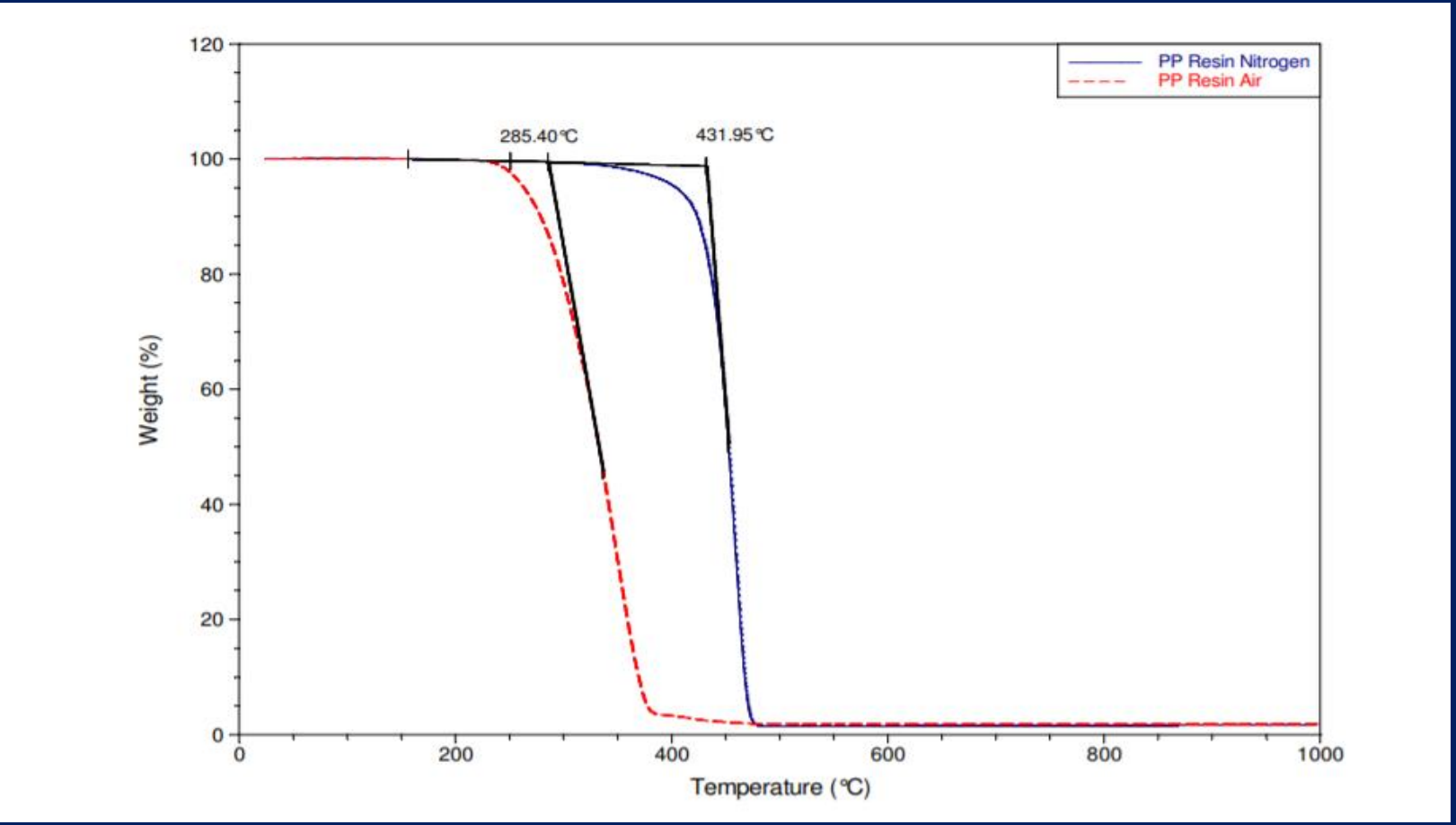
Automatic determination of a mixture of Calcium and Magnesium as their oxalates



Thermal stability of Polymers



Oxidative stability of Polypropylene



References

- VOGEL'S Text book of Quantitative Chemical Analysis, 6th Edition.
- Instrumental Analysis by Skoog, Holler and Crouch.
- TAINSTRUMENTS.COM

Thank You……