

# MSE-S310 Lecture 1

## Thermal Analysis Tools

THERMAL ANALYSIS (TA) refers to a group of techniques in which a property of a sample is monitored against time or temperature while the temperature of the sample, in a specified atmosphere, is programmed. Or THERMAL ANALYSIS (TA) means the analysis of a change in a property of a sample, which is related to an imposed temperature alteration.

**Thermal analysis** is a general term defining a technique used to analyze the time and temperature at which physical changes occur when a substance is heated or cooled. Each technique is **defined** according to the types of physical changes being analyzed

Thermal analysis is a scientific study of material properties under the changes of temperature or time. The following tools or methods are those common thermal analysis and instruments. Each technique is defined according to the types of physical changes being analyzed. When evaluating material characteristics, it is necessary to use different techniques or a combination of multiple techniques depending on the purpose.

### **Thermogravimetric Analysis (TGA)**

TGA measures the weight changes of the as a function of time or temperature. This method is effective in determining decomposition, oxidation or loss of solvent or water.

### **Differential Scanning Calorimetry (DSC)**

DSC is used to measure the energy absorbed or released on the sample, as a function of time or function of the temperature. DSC is useful to make the measurements for melting points, heats of reaction, glass transition, and heat capacity

### **Differential Thermal Analysis (DTA)**

DTA measures the temperature difference between the sample and the reference as the function of time temperature. This method is similar to DSC, but not quantify the amount of energy. It is usually working under high temperature. This method is used in the measurement of glass transitions, phase changes, and melting points can be measured.

### **Thermomechanical Analysis (TMA)**

TMA measures the dimensional changes on a sample as function of temperature. The various probes, were used to measure the properties of expansion, contraction, penetration, softening of the sample as well as glass transition.

### **Dynamic mechanical analysis (DMA)**

Dynamic Mechanical Analysis (**DMA**) is a technique that is widely used to characterize a material's properties as a function of temperature, time, frequency, stress, atmosphere or a combination of these parameters.

It is most useful for studying the viscoelastic behavior of polymers. A sinusoidal stress is applied and the strain in the material is measured.

### **Dielectric thermal analysis (DETA)**

Dielectric thermal analysis (DETA) is a materials science technique in which an oscillating electric field is used to analyze changes in the physical properties of a number of polar materials.