

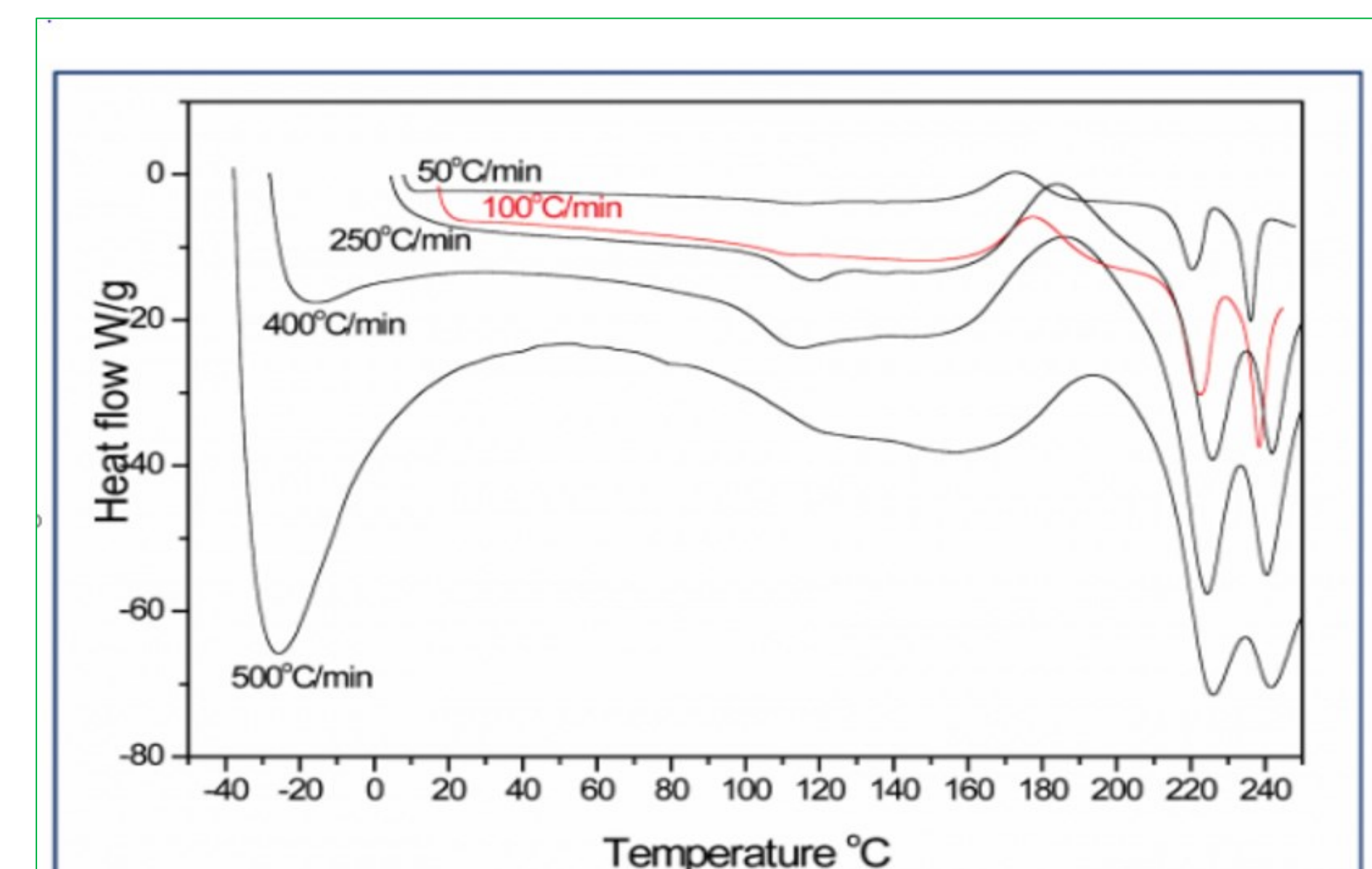
Thermal Analysis

Overview

Thermal analysis may be defined as the measurement of the physical and chemical properties of materials as a function of temperature or time. Thermal Analysis instruments typically measure heat flow, weight loss, dimension change, or mechanical properties as a function of temperature. Properties characterized include melting, crystallization, glass transitions, cross-linking, oxidation, decomposition, volatilization, coefficient of thermal expansion, and modulus. This allows the user to examine end-use performance, composition, processing, stability, and molecular structure and mobility.

Applications

Differential Scanning Calorimetry (DSC) measures the difference in Heat Flow Rate between a sample and inert reference as a function of time and temperature.



Perkin Elmer Pyris 1 DSC

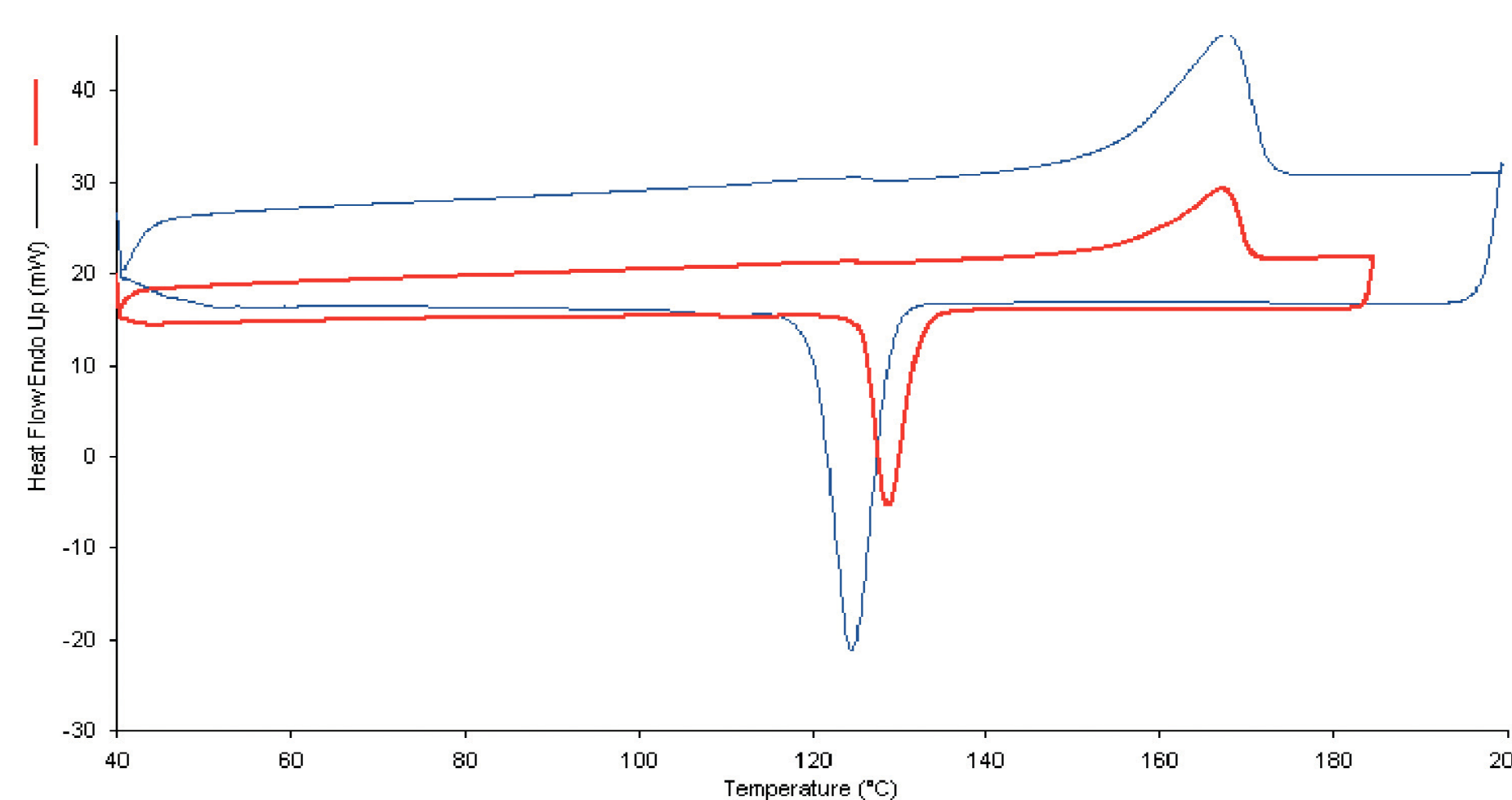
- The Intracooler allows temperature range of -60°C to $+600^{\circ}\text{C}$
- An air shield to prevent moist air from settling into, and maintaining the sample holder region dry and frost-free
- Samples as small as 1 mg can be analysed at rates of up to 300°C per minute.
- Specific Heat capacity measurement
- Power compensating calorimetry



Different ramp rates can show how the sensitivity towards the thermal transitions of a sample is increased at high heating rates (endothermic peaks are down)

DSC can

- Identify polymorphic forms of a compound
- be used to characterize a solid dispersion system
- determine the miscibility of the components for understanding of dissolution and release kinetics
- analyse the dissolution of solid dispersions
- Study of solid-state kinetics such as accelerated stability, decomposition, and the effects of aging on different pharmaceutical formulations



A Typical Pyris 1 DSC study of polyethylene (left). The blue curve illustrates the thermal characteristics of the parent polymer prior to processing. The red curve illustrates the different thermal properties of the reground polymer. This could affect the processing regime required to manufacture products with stable mechanical properties.

Contact Bernal Institute E: bernal.institute@ul.ie