Application News

SHIMADZU

THERMAL ANALYSIS T91

Measurement for Transition Heat of Plastics

- According to JIS K 7121-1987 -

Heat characteristics of high polymers, such as transition and decomposition, are measured by thermal analysis. However, measuring conditions such as sample shapes and filling methods may influence analytical results. For correct comparison, therefore, it became necessary to standardize measuring conditions. In October 1987, based on this, the Japanese Industrial Standards Committee standardized methods to measure transition heat and transition temperatures of plastics.
Reported herein are results of measurements where transition heat measurements of high polymers were observed per JIS K 7121-1987 "Testing Methods for Transition Temperature of Plastics."
According to JIS, there are two methods to measure a transition heat: (1) heating (heat of melting and cold crystallization) and (2) cooling (heat of crystallization). The method (1) is further classified as a method where measurement is taken after heat treatment, and the other as a method where no heat treatment is conducted before measurement.

Low density polyethylene (LDPE)

Owing to film form, a sample of low density polyethylene was cut into pieces in sizes that could be packed in a sample cell without trouble. They were then crimped and measured.
Shown measuring results were the temperatures at which it left the baseline before transition, returned to the baseline, and a reached peak-heat. The melting heat was 12.04KJ/kg.

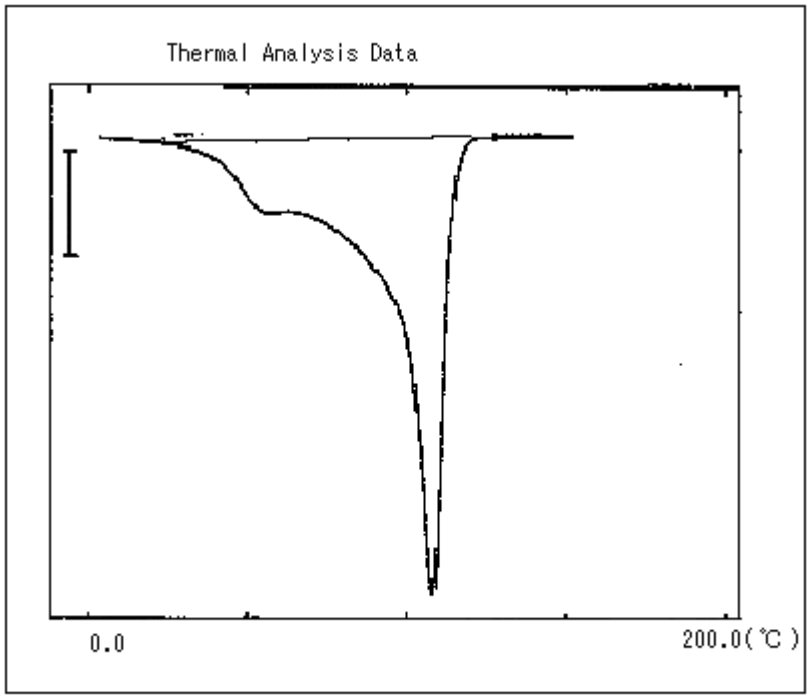

Fig. 1 Melting heat of LDPE

Polypropylene (PP)

In pellet form, a sample of polypropylene was sliced into pieces of 0.5 mm or thinner. The slices were then crimped and measured. The melting heat was 64.6KJ/kg.

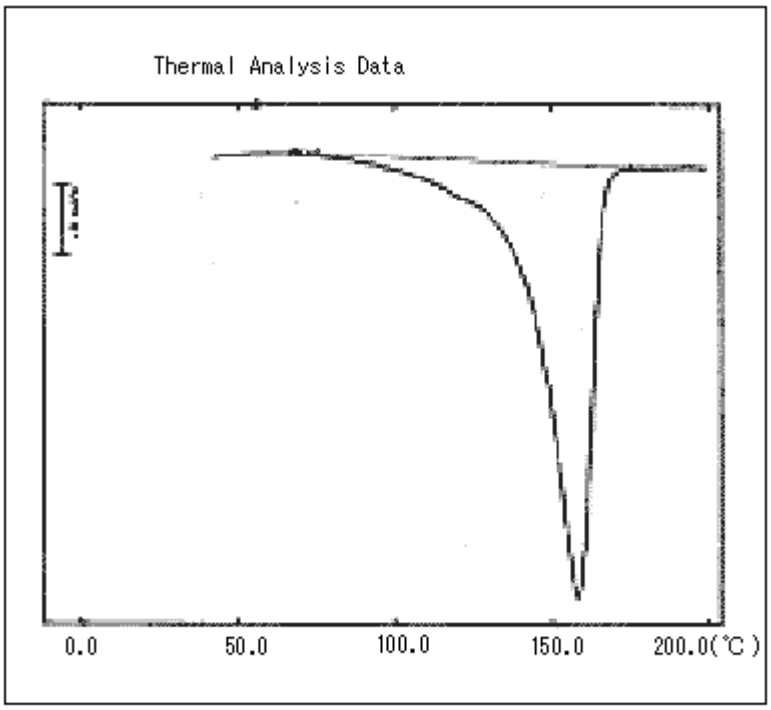

Fig. 2 Melting heat of PP

Polyethylene terephthalate (PET)

Measurement was taken to observe cold crystallization and melting heat after glass transition. The cold crystallization and melting heat 25.3KJ/kg and 40.8KJ/kg, respectively.

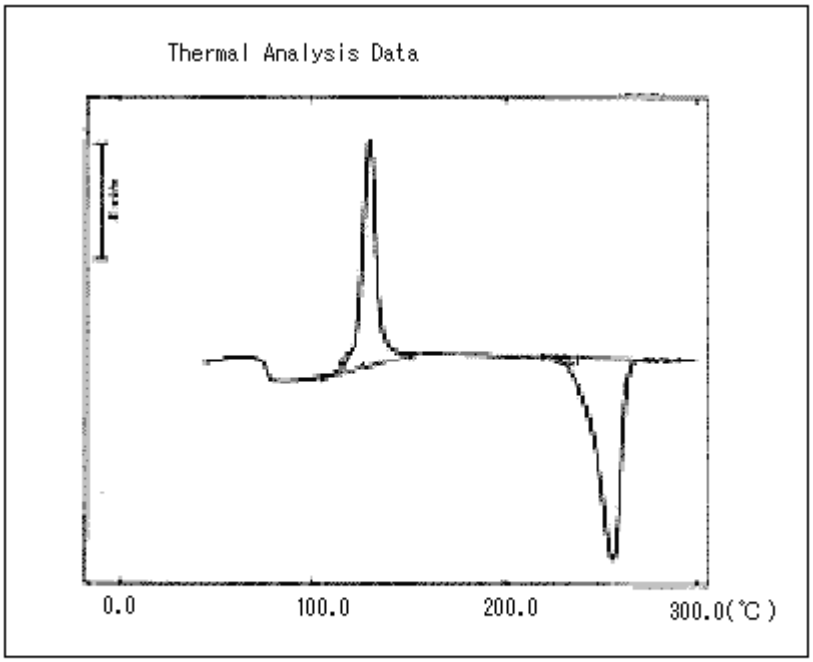

Fig. 3 Heats of cold crystallization and melting of PET

Polyethylene terephthalate (PET)

The method to measure the transition heat after heat treatment was adopted. Melting heat was measured based on a DSC curve, when a sample was retained for ten minutes at a temperature 30˚ C higher than that at end of peak of melting heat, cooled at 10˚ C/min, and reheated at 10˚ C/min.
The melting heat was 36.5KJ/kg.

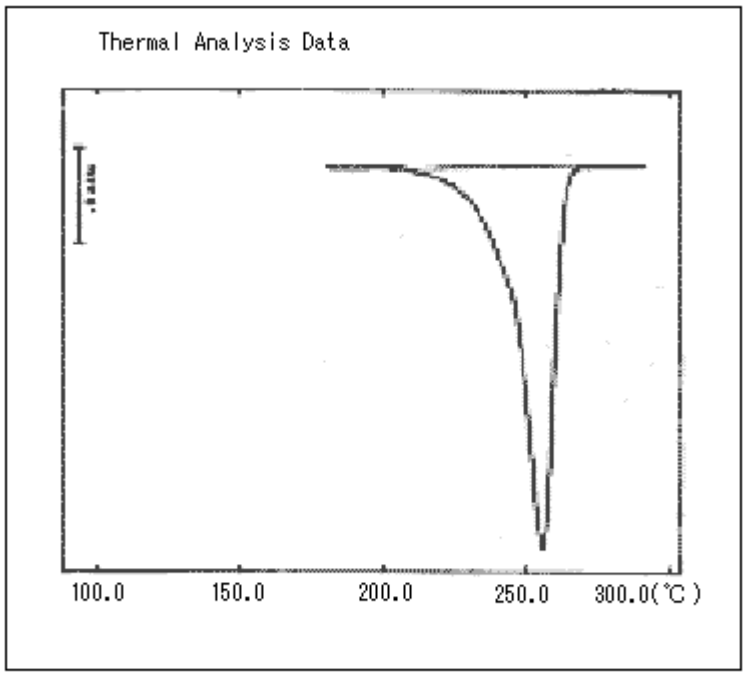

Fig. 4 Melting heat of PET

Polybutylene terephthalate (PBT)

The method to measure transition heat by cooling was adopted. Melting heat was measured based on a DSC curve, when a sample was retained for ten minutes at a temperature 30˚ C higher than that at the end of the transition peak, and cooled at 10˚ C/min.
The melting heat was 51.1KJ/kg.

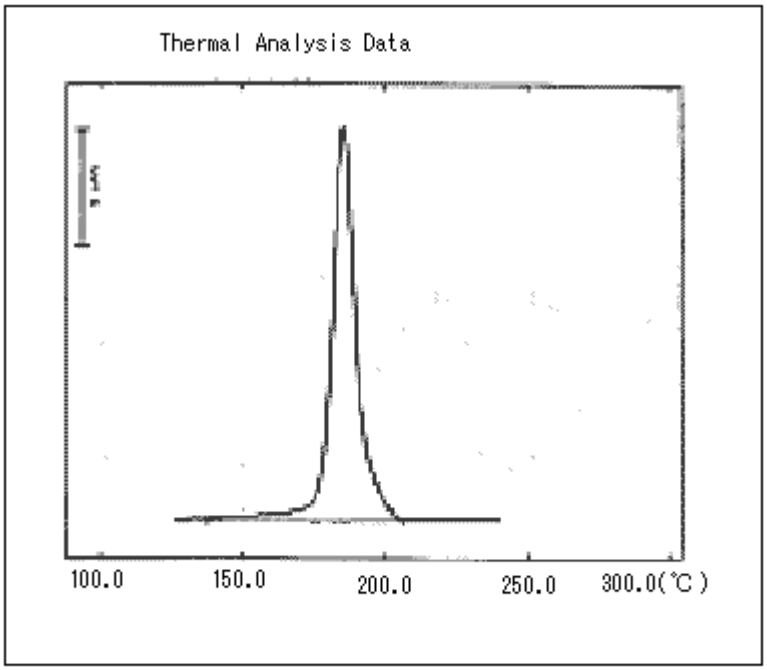

Fig. 5 Crystallization heat of PBT

* Please be advised that data obtained before the implementation of the current Weights and Measures Law may be presented in terms of gravimetric unit.

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