

APPLICATION SHEET

Thermoplastics – DSC 214 *Polyma*

High DSC Heating Rates: From Magnification to Concealment of Thermal Effects

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Introduction

The heating rate has a great influence on the results of a DSC curve. A faster heating rate magnifies the thermal effects, but can also hide kinetic events.

Test Conditions and Results

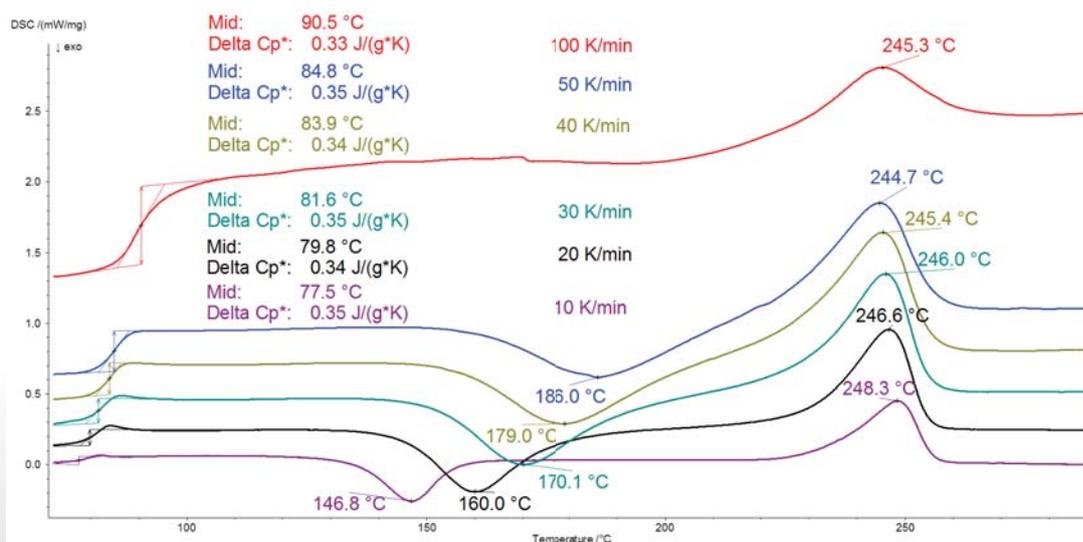
A PET sample (7.42 mg) was measured with the DSC 214 *Polyma* at different heating rates from 10 K/min to 100 K/min. The sample was cooled at a controlled rate of 30 K/min between each of the heating segments, so that the thermal history was identical at the beginning of each heating. The DSC curves are displayed in figure 1.

The DSC measurement at 10 K/min (violet curve at the bottom) shows an endothermic step at 77.5°C (midpoint) that results from the glass transition of PET. The peak at 146.8°C (peak temperature) is due to the so-called post-crystallization of PET. The amorphous phase of this polymer is

well-known to be able to crystallize during heating. Finally, the polymer melts at 248.3°C (peak temperature).

These effects, also detected in the measurements at 20 to 50 K/min, are influenced by the variation of the heating rate. The glass transition step becomes larger in height and width as the heating rate increases, as do the crystallization and the melting peaks. As a result, the separation of the exothermic and endothermic peaks becomes more and more difficult. Otherwise, the glass transition and crystallization are shifted to higher temperatures with increasing heating rates as expected. Only the position of the melting peak was not influenced by the heating rate, most probably because of the overlapping of crystallization and melting effects.

However, the DSC curve carried out at 100 K/min (red curve) does not exhibit any post-crystallization peak. This is caused by the suppression of kinetic effects when working at high heating rates.



1 Influence of the heating rate on the thermal effects of PET