Peak Separation Software – Easy Identification of the Components in a Multilayer

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Test Conditions

A multilayer containing different polyethylenes was measured with the DSC 214 Polyma at different heating rates from 5 K/min to 500 K/min between -20°C and 150°C. The sample was cooled at a controlled rate of 20 K/min between each heating in order to achieve the exact same thermal history at the beginning of each heating.

Test Results

The DSC curves are displaced in figures 1 and 2. The double peak detected in all segments of figure 1 (heating rate between 5 and 50 K/min) is related to the melting of polyethylenes.

As expected, the melting peak temperatures are shifted to higher values with increasing heating rates; i.e., the first peak determined at 110.2°C in the measurement at 5 K/min is shifted to 113.1°C for the measurement at 50 K/min (figure 1, violet and red curves). In addition, the effects are more pronounced in both height and width.

Figure 2 shows that the heating rate also influences the resolution of the peaks: separation is improved at lower heating rates. Whereas two well separated peaks can be evaluated in the measurements at 50 K/min or lower,
the presence of the first component is only demonstrated by a shoulder in the curves for the measurements at 100 K/min and 200 K/min. At even higher heating rates (300, 400 and 500 K/min), only a single peak was detected.

The NETZSCH Peak Separation Advanced Software was used to separate the two peaks detected in the measurement at 5 K/min. Figure 3 shows that the correlation between the measured double peak (dotted curve) and the overlapping of not two, but three different peaks with maxima at approx. 110°C (green curve), 115°C (blue curve) and 120°C (orange curve) is excellent. These three curves are most probably due to the melting of different polyethylene types.

**Conclusion**

The heating rate used in DSC influences the detected melting peaks in two ways: an increase in the heating rate magnifies the thermal effects, whereas a decrease in the heating rate yields a better separation of these effects. By using a low heating rate in combination with the NETZSCH Peak Separation software, the different components of a multilayer can be identified.