

## Appendix A

### FURTHER DETAIL FROM DSC THERMOGRAMS

There are a number of individual thermograms that show specific details not sufficiently evident in the combined thermograms. These specific thermograms have been reproduced in an expanded form to highlight the subtleties.

#### A.1 Chapter 5 polyamide-6,9 with carbazole

Section 5.3.2.6 Third Crystallisation of Materials/Second DSC Crystallisation at 2 °C/min.

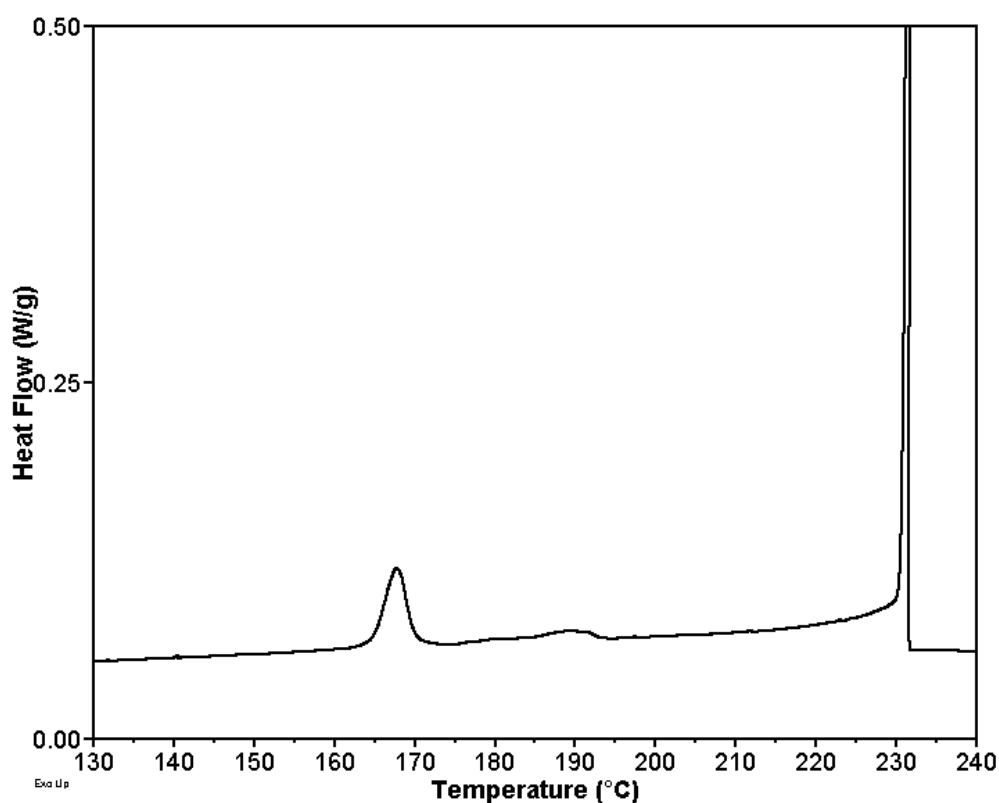


Figure A-1 Crystallisation of a small amount of pure polyamide-6,9 at 190 °C can be seen in the second DSC crystallisation of the ampoule sample 28PA69Car.

Evidence for a minimal amount of pure polyamide-6,9 can be seen to crystallise for the ampoule sample 28PA69Car at 190 °C in Figure A-1.

## A.2 Chapter 6 polyamide-6,12 with carbazole

Section 6.3.2.3 *DSC Crystallisation Temperatures at 2 °C/min for remelted ampoule material.*

The nearly concurrent crystallisation of polyamide-6,12 and carbazole for the ampoule sample 70PA612Car in its first DSC crystallisation can be seen in Figure A-2.

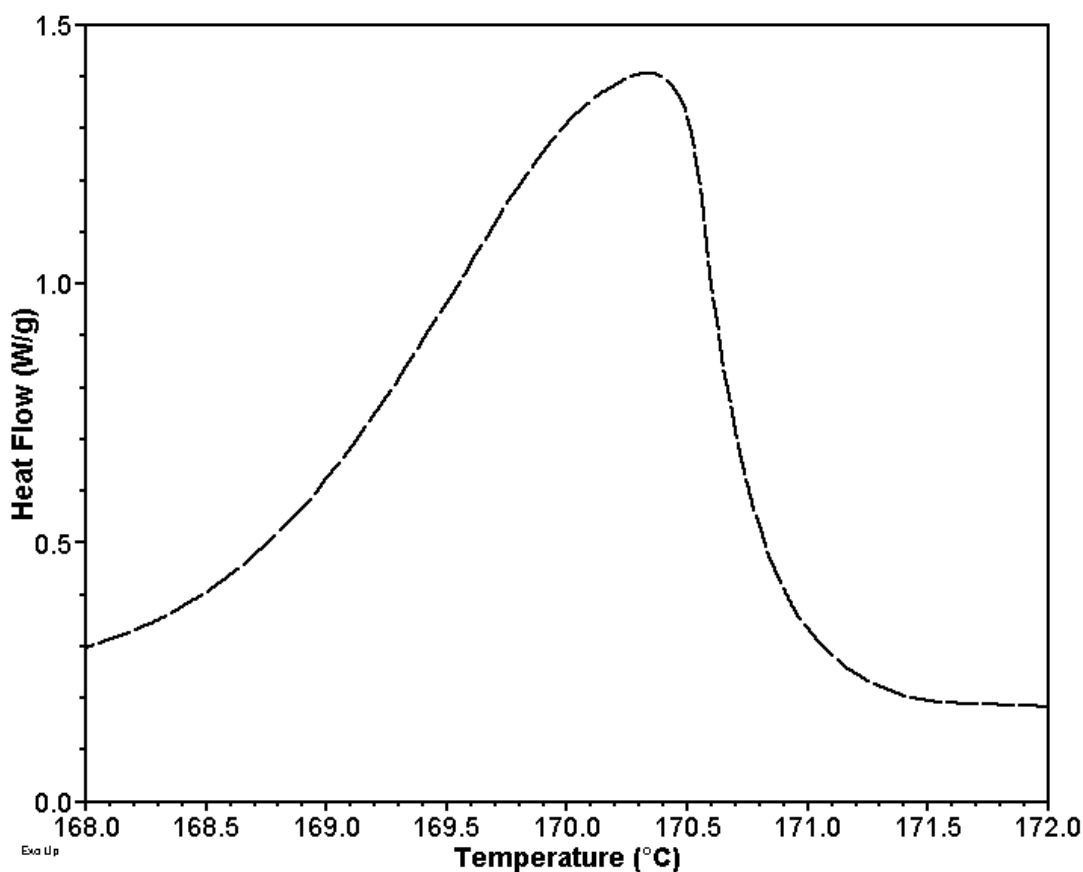


Figure A-2 DSC thermogram of the first crystallisation at 2 °C/min in the DSC of 70PA612Car ampoule sample showing a slow start to the crystallisation followed by a near vertical section of carbazole crystallising and followed by the crystallisation of polyamide-6,12 with a small peak visible at 169.9 °C.

### A.3 Chapter 8 polyamide-6 with phenothiazine.

#### Section 8.3.1.1 Melting Temperatures for first heating ramp of the dry powders at 5 °C/min

The DSC heating ramp for the dry powders of 83PA6PTh in Figure A-3 shows detail of the complex dissolution of phenothiazine into amorphous and/or crystalline polyamide-6 showing the faint peaks at 160 and 170°C before the main melting peak in the range 190 to 220 °C.

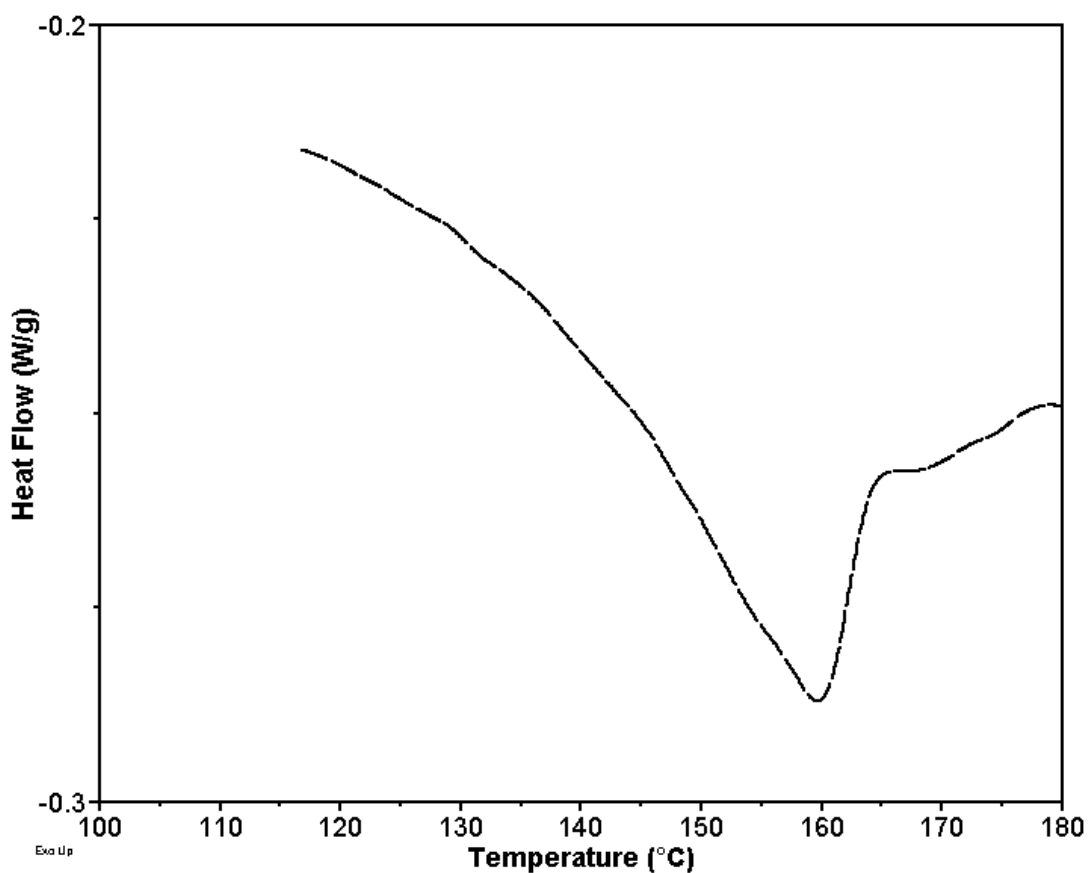


Figure A-3 DSC thermogram of the lead processes before the main melting peak for 83PA6PTh in taking the powders to the melt.

*Section 8.3.1.2 Crystallisation for first cooling ramp of the molten blend at 25 °C/min.*

The first crystallisation of the pan blended 83PA6PTh is a skewed main peak that on closer examination can be shown to be a double peak in Figure A-4.

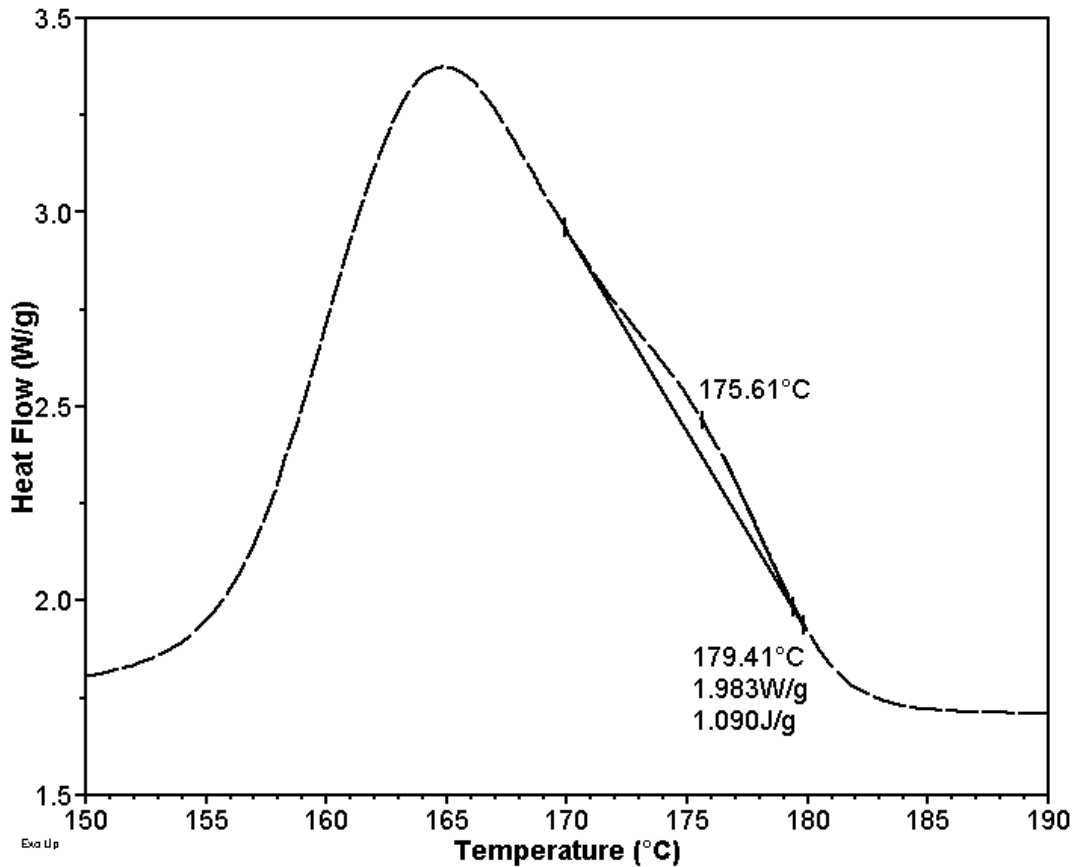


Figure A-4 DSC thermogram of the pan blended 83PA6PTh sample crystallising for the first time at 25 °C/min and showing a peak for the crystallisation of pure polyamide-6 just before the main crystallisation peak and demonstrating some phase separation.

## A.4 Chapter 9 polyamide-6,9 with phenothiazine

### Section 9.3.1.2 Crystallisation for first cooling ramp of the molten blend at 25 °C/min

The treble peak for the first crystallisation of the pan blended 63PA69PTh with the first two close to each other can be seen better here in Figure A-5 than in Chapter 9.

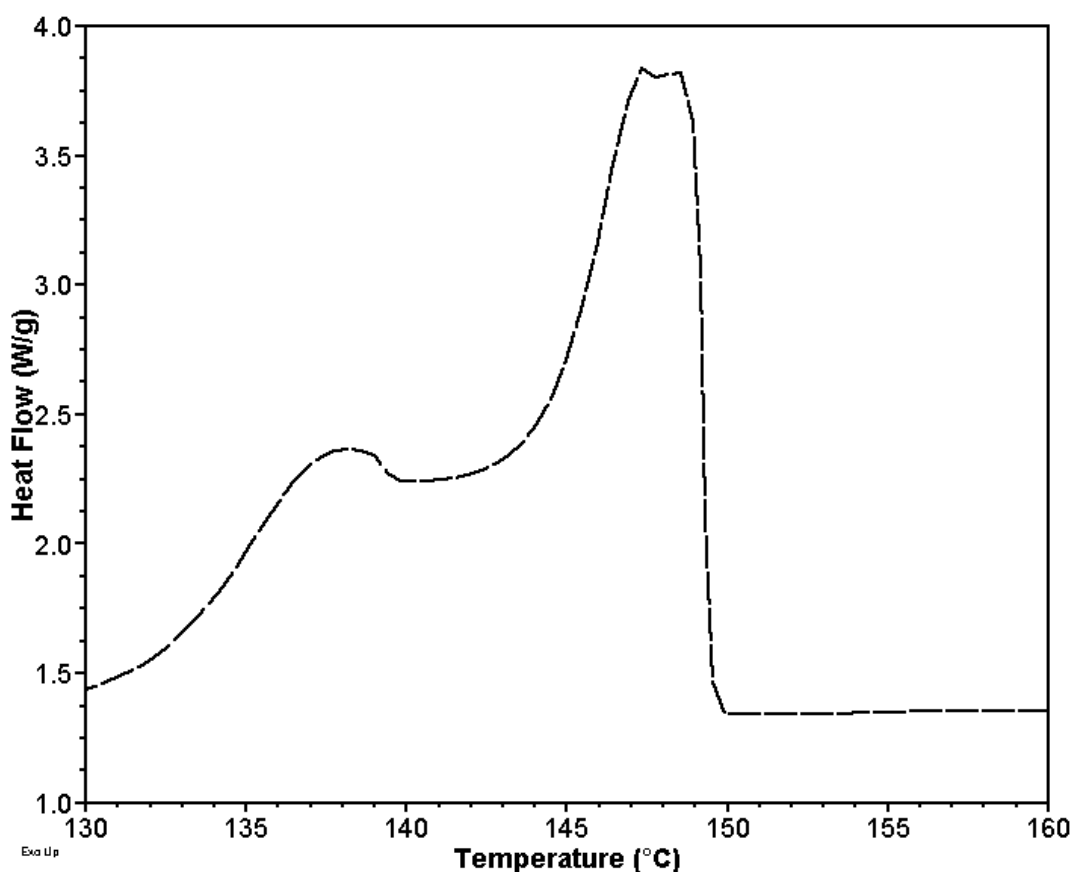


Figure A-5 First crystallisation at 25 °C/min of the pan blended 63PA69PTh with the first two peaks of the treble peak being almost co-incident in time. The treble peak starts with a very small crystallisation, presumably of polyamide-6,9 that immediately changes into the distinctive phenothiazine crystallisation before changing concentrations induce polyamide-6,9 crystallisation.

The first crystallisation of the pan blended 50PA69PTh in Figure A-6 incorporates three parts, a slow start to the crystallisations taking place, a straight section with the DSC signal rising linearly as with other phenothiazine and carbazole crystallisations, that peaking near 132 °C and changing into the main peak for the polymer crystallising that has a maximum near 130 °C.

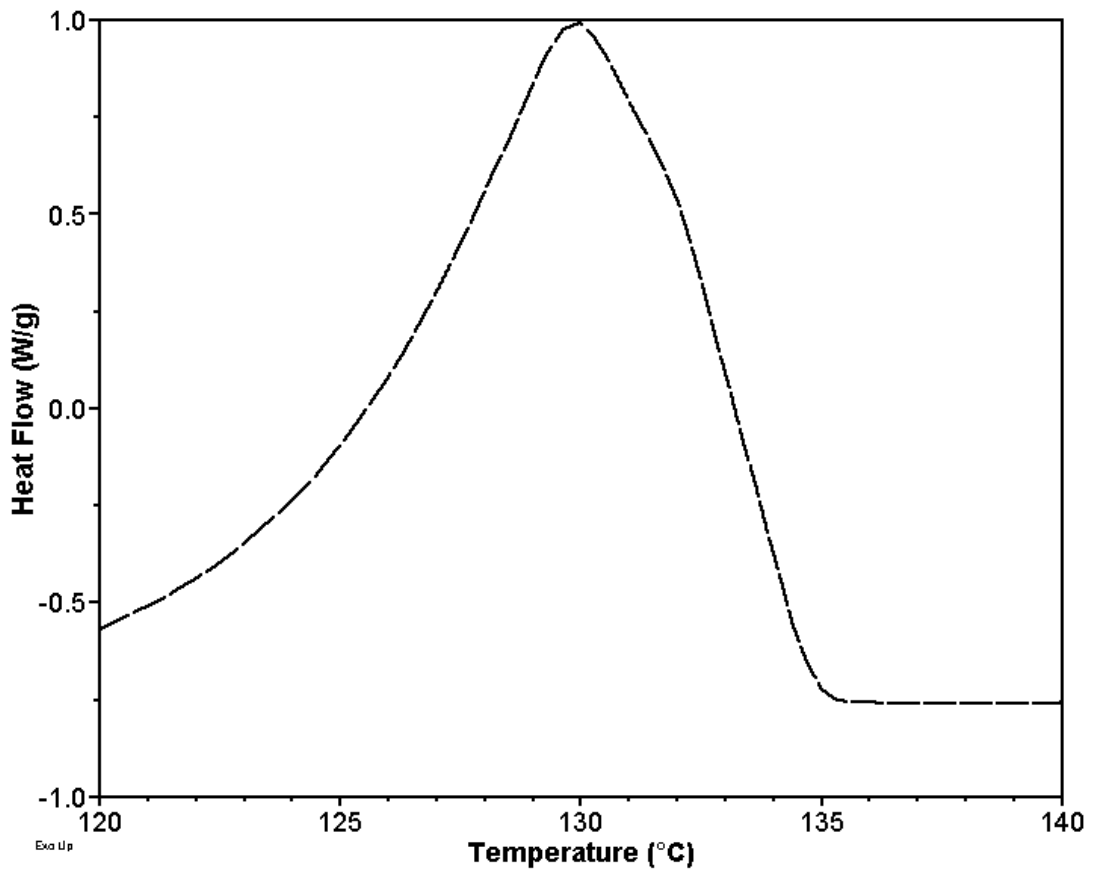


Figure A-6 Double peak in the first crystallisation of pan blended 50PA69PTh showing the transition between phenothiazine crystallising with a maximum rate at 132 °C and polyamide-6,9 crystallising with a maximum at 130 °C.

Section 9.3.2.3 First time crystallisation in the DSC at 2<sup>0</sup>C/min of ampoule samples

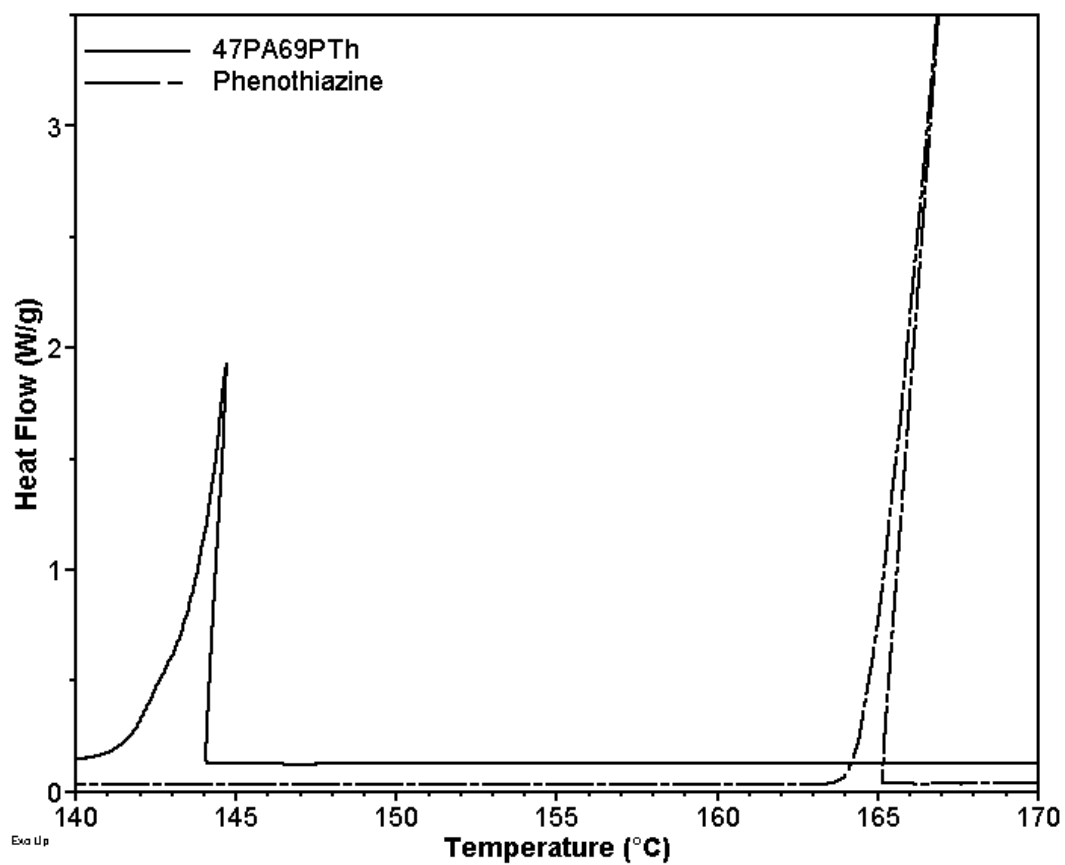


Figure A-7 Comparison between the first crystallisation in the DSC of ampoule samples 47PA69PTh and phenothiazine showing the polymer crystallisation peak near 142.5 °C and the much broader base of the initially “spiky” peak

## A.5 Chapter 10 polyamide-6,12 with phenothiazine

### Section 10.3.1.1 Melting Temperatures for first heating ramp of the dry powders at 5 °C/min

Figure A-8 shows the residual thermal activity before the main melting peak for polyamide-6,12 powder reflecting stress relaxations and the melting/recrystallisation of metastable lamellae.

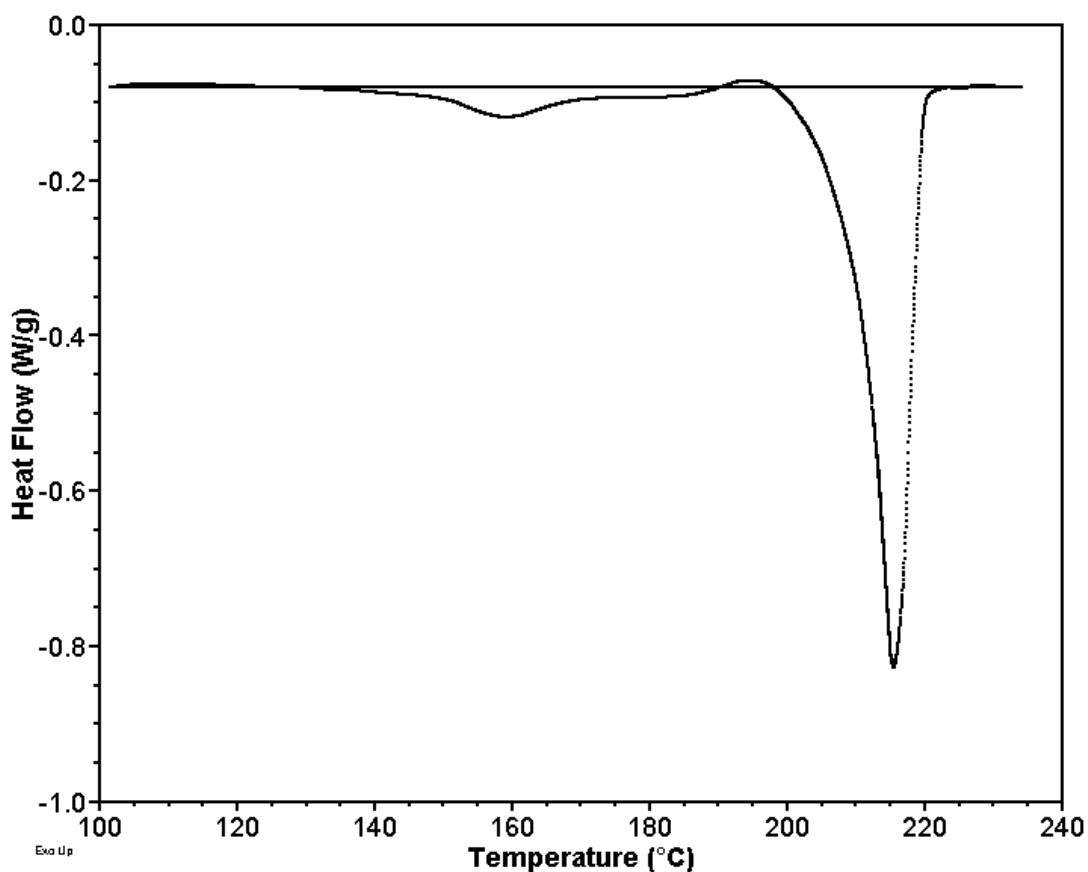


Figure A-8 Melting polyamide-6,12 powder at 5 °C/min displaying the thermal activity before the main melting peak due to stress relief and melting/recrystallisation of metastable lamellae. A baseline has been inserted to make the endothermic and exothermic activity clearer.

Section 10.3.1.3 Melting Peak Temperatures for second heating ramp at 5<sup>o</sup>C/min

The pan blended sample 36PA612PTh shows a slight amount of melting and recrystallisation in the lead up to the main melting peak during its second DSC heating ramp in Figure A-9. This is helped by studying the first derivatives of the heat flow signal.

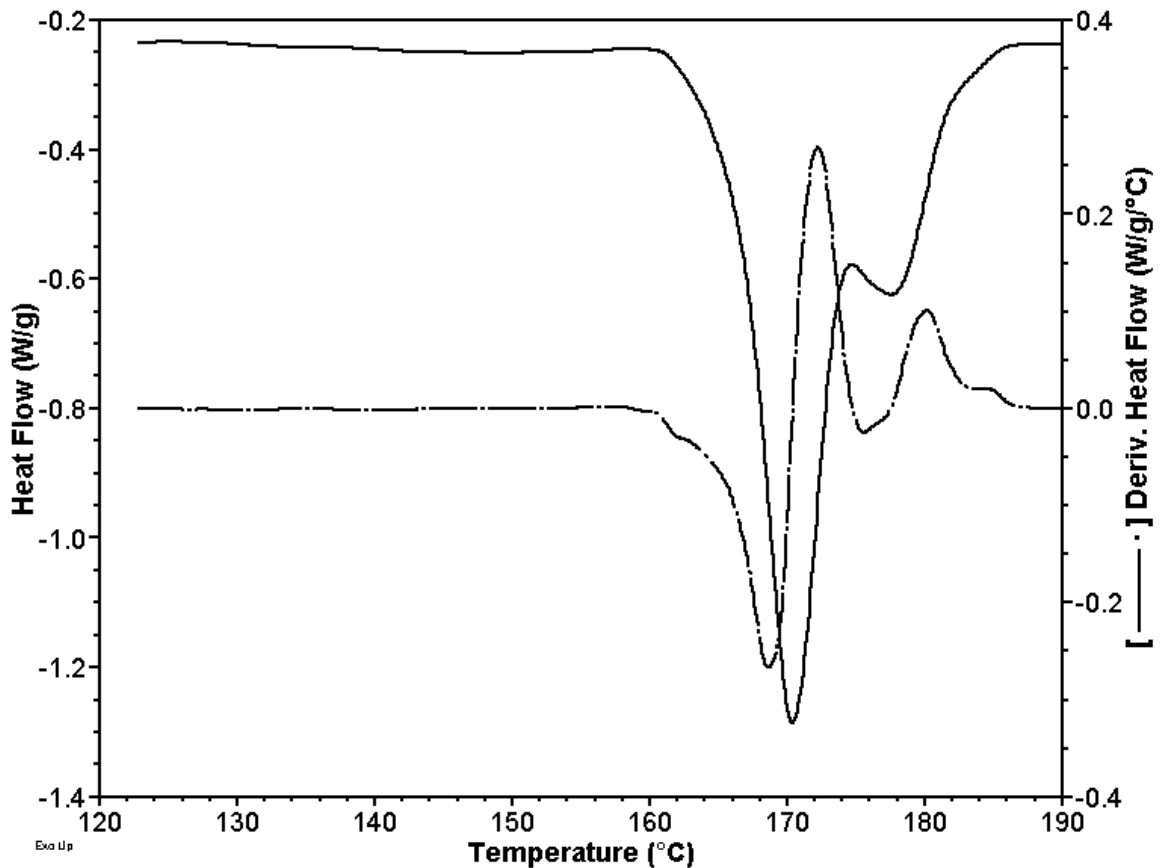


Figure A-9 Heat Flow and the first derivative of heat flow for the second DSC melting ramp of 36PA612PTh with the lead up to the main melt showing slight melting and recrystallisation of metastable lamellae by 161 °C.