



	<b>Experiment title:</b> Annealing effects on morphology and mechanical properties of polypropylene	<b>Experiment number:</b> MA-918
<b>Beamline:</b>  BM26B	<b>Date(s) of experiment:</b>  from 04/12/2009 at 8:00 to 06/12/2009 at 8:00	<b>Date of report:</b>  21/12/2009
<b>Shifts:</b>  9	<b>Local contact(s):</b>  Dr. Guiseppe PORTALE	
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### Report: (max. 2 pages)

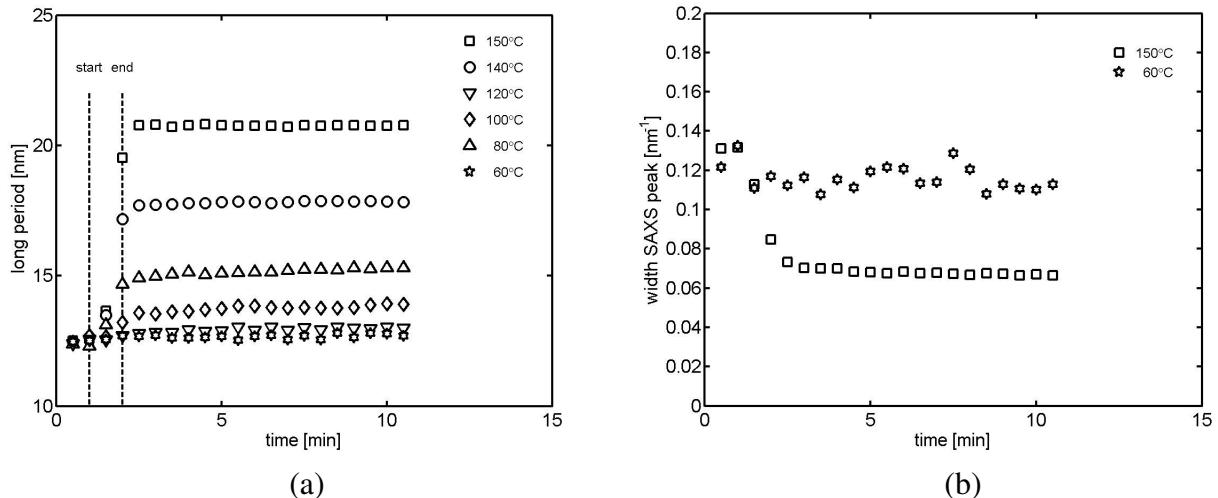
In this project, we aimed to study the influence of ageing/annealing effects on morphological developments in semi-crystalline polypropylene, especially related to the resulting mechanical properties. In this experiment it is tried to follow the development of the morphology, i.e. structural changes, upon real-time annealing of the samples by means of X-ray scattering techniques (SAXS and WAXD).

#### SAXS results

The Linkam Hot Stage is used to follow the morphology changes during real-time annealing. Starting temperature of the samples was 30°C and heating rate was adapted in such a manner that the final annealing temperature was reached in 60 seconds. The experiment is stopped after 10 minutes, since ex-situ X-ray results of annealed samples at different annealing temperatures and times showed that already within 10 minutes a considerable change in morphology is observed.

Figure 1a shows the resulting change in long period. A remarkable jump in long period is observed during 1 minute of heating. It is known that the long period is steadily growing in time upon annealing. The ex-situ results showed this increase, however this increase of 2-3nm over 300 hours is almost negligible compared to the sudden jump in long period in the first minute.

The SAXS data is fitted with a Gaussian function to extract information about the average and the distribution of long periods. Figure 1b shows that the distribution is narrowing upon annealing, meaning that the smaller crystallites disappear.



**Figure 1** (a) Long period (calculated from SAXS) versus time during in-situ annealing in DSC. The dotted lines are representative for the start and end of the heating ramp. (b) The width of the SAXS peak versus time.

### WAXD results

From a mechanical point of view, both crystallinity as well as lamellar thickness are the key parameters. The ex-situ results on annealed samples showed, as expected, an increase of crystallinity and thus an increase in lamellar thickness upon annealing time and temperature. Similar results are expected during in-situ annealing in the DSC apparatus.

The WAXD data analysis is currently being performed.