



	Experiment title: Annealing effects on morphology and mechanical properties of polypropylene	Experiment number: MA-918
Beamline: BM26B	Date(s) of experiment: from 04/12/2009 at 8:00 to 06/12/2009 at 8:00	Date of report: 21/12/2009
Shifts: 9	Local contact(s): 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.

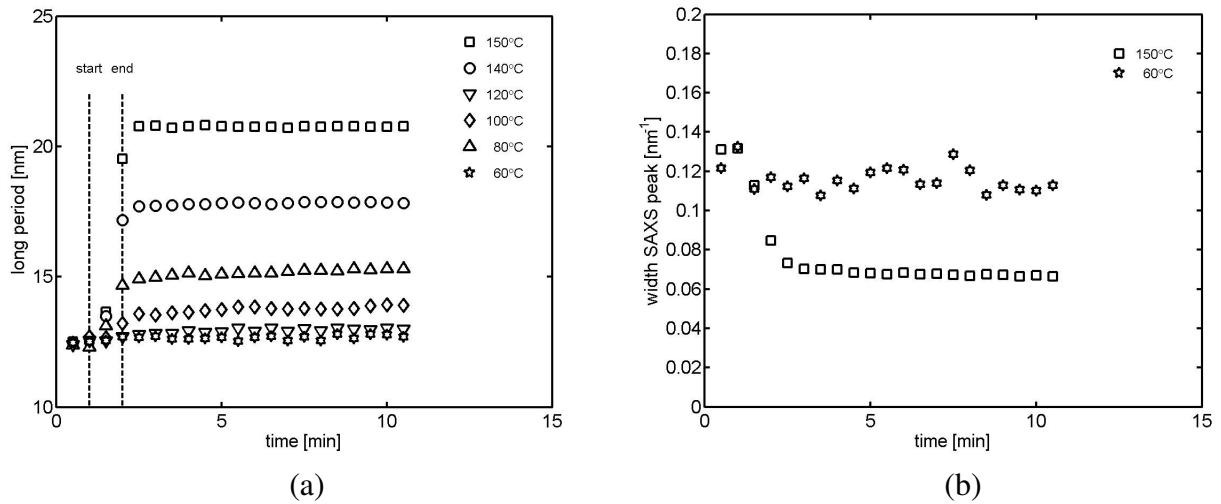


Figure 1 (a) Long period (calculated from SAXS) versus time during in-situ annealing in DSC. The dotted lines are representative for the start and end of the heating ramp. **(b)** The width of the SAXS peak versus time.

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.