DUBBLE – EXPERIMENT REPORT

Beam time number: MA - 1859		File number: P31040 (proposal file number)
Beamline: BM26-B	Date(s) of experiment: 30/04 – 02/05 2013	Date of report: 20-01-2014
Shifts: 6	Local contact(s): D. Hermida-Merino	

1. Who took part in the experiments?

Martin van Drongelen[1]
Benny Luijsterburg[2]
Harm Caelers[1]
Affiliation: 1. Material Technology Group, Department of Mechanical Engineering, Eindhoven University of Technology. 2. Laboratory of Polymer Materials, Department of Chemical Engineering and Chemistry, Eindhoven University of Technology

2. Were you able to execute the planned experiments?

YES. All the planned experiments were performed. We were able to monitor the structure evolution along the film line for three different materials at four different processing conditions.

3. Did you encounter experimental problems?

YES. Due to an unexpected level of misalignment/damage of the die, the exact reproducibility of the experiments proved to be low, simply because the structure evolution at the location of the beam was very much influenced by the conditions, i.e. rheology, crystallization and temperature, within the surrounding material.

4. Was the local support adequate?

YES. The support of the local contact, D. Hermida-Merino and the technical staff was needed to accurately set up the (large) experimental equipment, see Figure 1.

Figure 1: The film blowing setup installed in the experimental hutch of DUBBLE.

5. Are the obtained results at this stage in line with the expected results as mentioned in the project proposal?

YES. At this point, the largest part of the data is analysed. In correspondence with the proposal, we were able to measure the influence of different deformation rates and cooling histories, at different heights - from the die exit to beyond the solidification line. Figure 2 shows an example of the evolution of crystallinity with distance from the die for the three investigated materials.

The 2D WAXD patterns were also used to extract information on the molecular orientation in the machine direction (MD). From Figure 3 it can be deduced that the a- and c- axis gradually orient in MD while the b-axis grows perpendicular to MD. Although the level of orientation is low, i.e. the influence of flow is limited, the results indicate the formation of oriented spherulites and/or low levels of oriented shish-kebab structures.

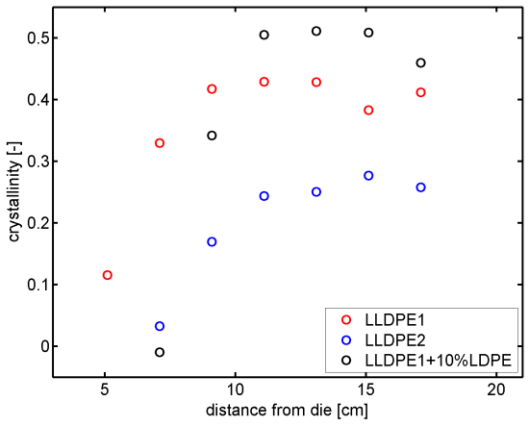

Figure 2: Crystallinity fraction as function of distance from the die for the investigated materials.

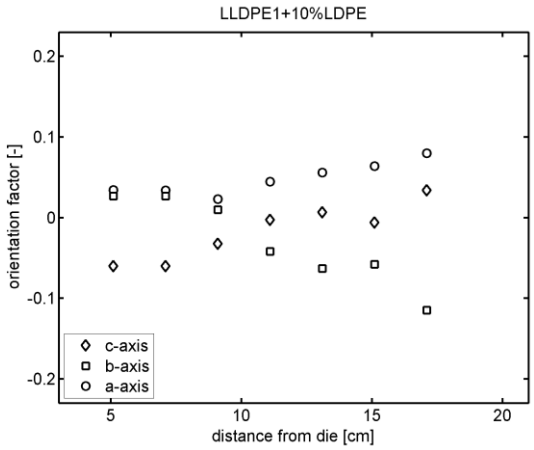

Figure 3: Herman's orientation for the a-, b- and c-axis in the MD as function of the distance from the die.

6. Are you planning follow-up experiments at DUBBLE for this project?
YES. After a complete and adequate repair of the experimental equipment (film blowing mast and die) and extensive in-house testing, we plan to repeat the experiments in the future and show the feasibility of combining film blowing with in-situ waxd in near-industrial processing conditions.

7. Are you planning experiments at other synchrotrons in the near future?
NO.

8. Do you expect any scientific output from this experimental session (publication, patent …)
NO. Due to the severe misalignment of the die and low reproducibility the acquired data does not qualify for publication, rather is serves as valuable data from which to understand the difference in crystallization kinetics between the materials investigated (and as function of processing conditions), which can be used for a future publication.

9. Additional remarks