

DUBBLE – EXPERIMENT REPORT

We kindly request you to answer the questions (max 2 pages) and return the form to NWO **within 2 months of the completion of the experiment** to dubble@nwo.nl

Beam time number: 26-02-613		File number: p30293 (proposal file number)
Beamline: BM26-B	Date(s) of experiment: 01/10 – 05/10 2012	Date of report: 29-11-2012
Shifts: 9	Local contact(s): Dr. Giuseppe Portale	

1. Who took part in the experiments?

Dario Cavallo
Harm Caelters
Marc Kanters

Affiliation: Material Technology Group, Department of Mechanical Engineering, Eindhoven University of Technology

2. Were you able to execute the planned experiments?

YES, all the planned experiments were performed successfully

3. Did you encounter experimental problems?

NO, no particular problems were encountered

4. Was the local support adequate?

YES. Both the support of the local contact, Dr. Giuseppe Portale and of the technical staff was highly important for the success of the experiments

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

YES. Results have been partially analyzed so far (approximately 66%) and some interesting observation can be made. According to the experimental proposal we were able to observe the evolution of density fluctuations in a polymer glass (Polystyrene and polycarbonate) during uniaxial compression. Figure 1 shows an example of the measured stress-strain curves.

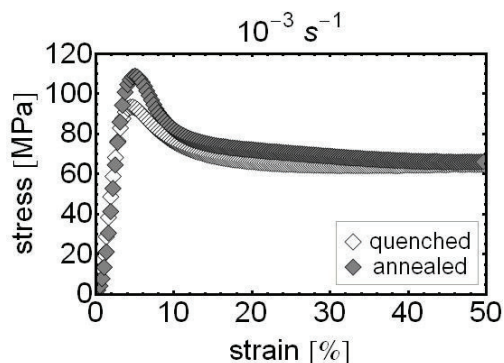


Figure 1. Typical stress-strain curves for quenched and aged polystyrene

Remarkable changes in the concentration of density fluctuations and in the correlation between

neighbouring polymer chain segments were observed upon reaching and surpassing the yield point, i.e. upon mechanical rejuvenation.

An example of the evolution in the scattering pattern with increasing strain is provided in Figure 2.

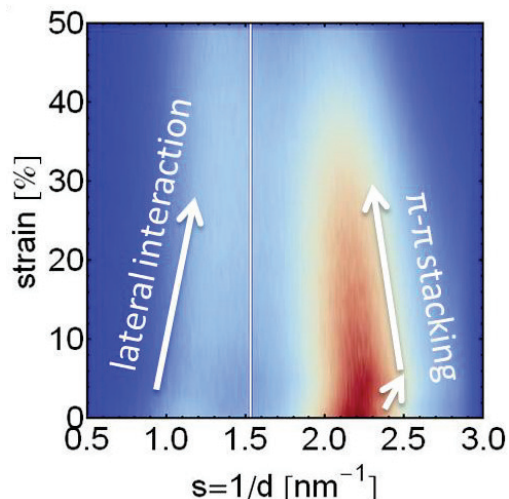


Figure 2. density plot of the scattering patterns during deformation.

The different maxima in the diffractograms can be associated to lateral chain correlation and to stacking of the phenyl rings. Scattering patterns have been deconvoluted to extract information about structural changes in the material upon deformation, particularly regarding the bragg distance and the intensity of the reflections. An example of the obtained result for quenched polystyrene sample is provided in Figure 3.

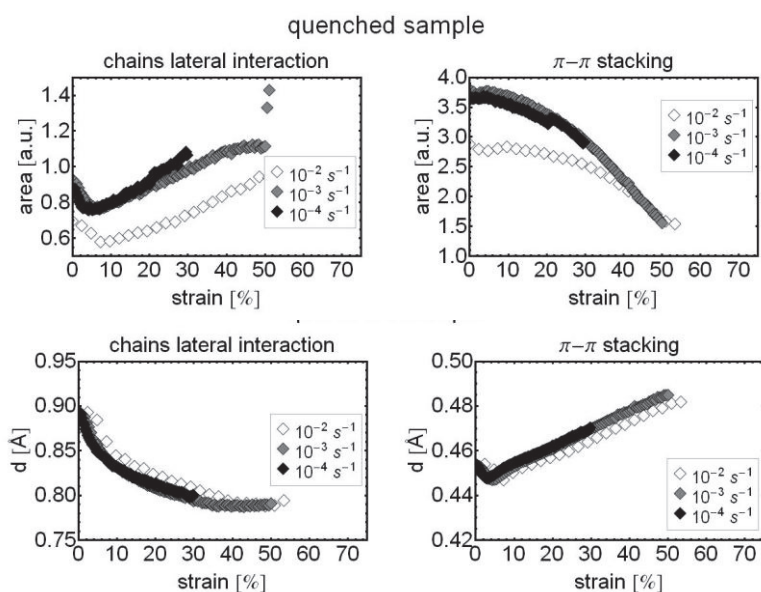


Figure 3. evolution of structural features of polystyrene samples deformed at different strain rates, deduced from in-situ WAXD during uniaxial compression.

Further analysis on cyclic load tests are needed to assess the reversible/irreversible nature of this changes and to help the interpretation.

6. Are you planning follow-up experiments at DUBBLE for this project?

NO. This was the last part of a previously started project, with this experiments we should have completed the intended research.

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, ...)

YES. We would expect that the result obtained in this beamtime will result in a scientific publication, to be prepared and submitted in 2013.

9. Additional remarks