In-situ X-ray studies during deformation of rubber toughened amorphous polymers

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Introduction

The toughness of brittle amorphous polymers can be improved by making the material locally extremely thin [1]. Therefore the ultimate objective of the present research is the development of ductile 'engineering foams' based on this class of polymers. Current research is focussed on:

- the preparation of nano-sized rubber morphologies
- the relation between these morphologies and the mode of microscopic deformation

Experimental

In-situ small angle x-ray scattering (SAXS) experiments during tensile testing were performed on PPO-rubber modified PMMA with nano-sized morphologies. The data were analysed as schematically presented in figure 1.

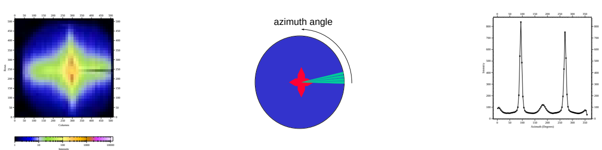

fig. 1 *a) two dimensional SAXS pattern, b) integration over the azimuthal angle (divided in 90 bins, one bin is represented by a green triangle), c) azimuth angle vs integrated intensity*

Results

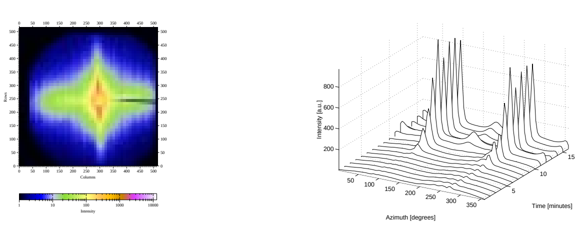

fig. 2 *PMMA/PPO* ***90/10*** *a) SAXS pattern measured during final time frame, b) azimuth angle vs integrated intensity as function of deformation time*

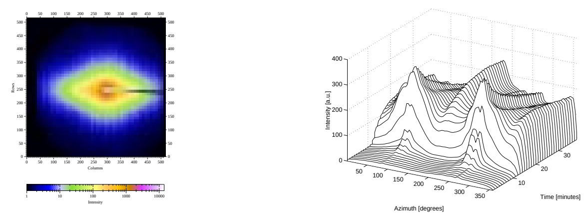

fig. 3 *PMMA/PPO* ***80/20*** *a) SAXS pattern measured during final time frame, b) azimuth angle vs integrated intensity as function of deformation time*

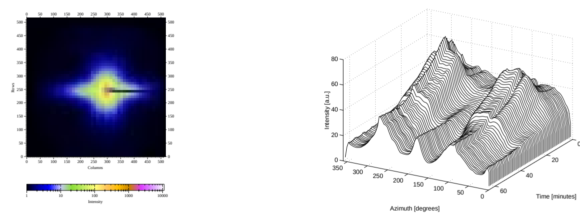

fig. 4 *PMMA/PPO* ***70/30*** *a) SAXS pattern measured during final time frame, b) azimuth angle vs integrated intensity as function of deformation time*

Conclusions

In-situ SAXS tensile test experiments are proven to be a powerfull tool to characterize the microscopic mode of deformation. The observed x-ray patterns for the studied PMMA/PPO blends are attributted to crazing (90/10) [2], rubber cavitation followed by shear yielding (80/20) and shear yielding (70/30).

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[1] M.C.M. van der Sanden, H.E.H. Meijer, P.J. Lemstra,: *Polymer*, 1993, **34**, 2148.

[2] H.R. Brown, E.J. Kramer,: *J. Macromol. Sci.-Phys.*, 1981, **B19**, 487.