ESRF	**Experiment title:** **Electric-Field-Induced Selective Melting in Block Copolymer Systems**	**Experiment number**: SC-2763
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Report:

This report deals with the beam time of the project SC-2763. According to our proposal we have further investigated the electric field induced disordering of lamellar microstructured poly(styrene-*b*-isoprene) (PS-*b*-PI) in toluene. In our temperature-controlled, home-built capacitor we were able to measure the order-disorder transition temperature T_{ODT} with various different electric field strengths applied. By evaluating SAXS patterns in five sectors, between 90° and 180° we were able to determine the degree to which T_{ODT} is shifted by the external stimuli, dependent on initial lamellar orientation. We found that indeed there is a large discrepancy between lamellae oriented parallel and perpendicular to the electric field vector. Whilst T_{ODT} for the former orientation remains fairly invariant, there is a strong decrease of about 7°C (dropping from 54°C to 47°C) when increasing the field to 8 kV/mm.

In a different set of experiments we heated our sample close to this order-disorder transition and induced disorder by suddenly applying a field, taking images with a high time resolution in the process. We found initial orientation of the structure parallel to the field, and consequent melting of the structures. It is however so far somewhat ambiguous whether this is evidence for selective disordering of perpendicular lamellae and consequent melting of the entire morphology, or pure reorientation followed by a disordering of the entire sample.

Currently we are collecting and summarizing more data in preparation of a manuscript for publication towards the end of this year.

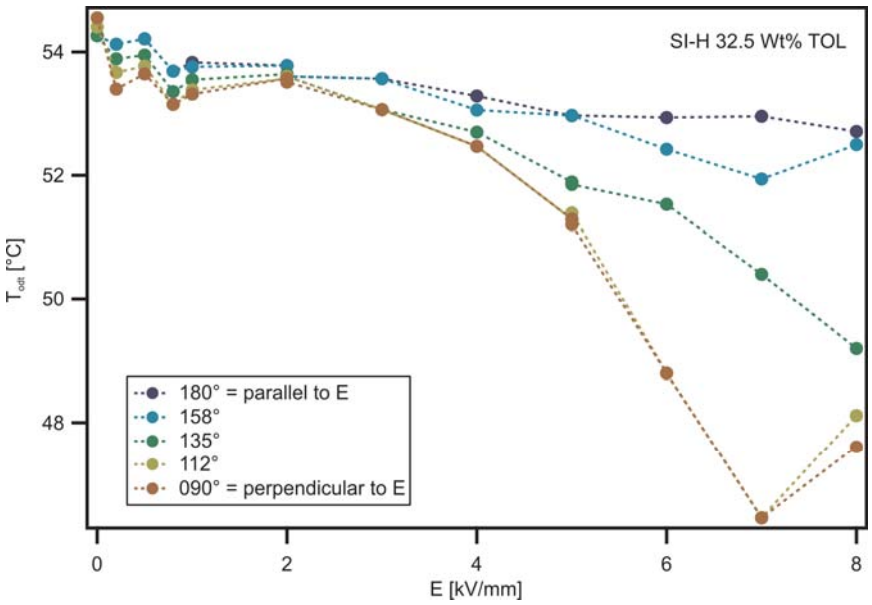

Figure 1: Dependence of T_{ODT} on the electric field strength E. clearly lamellae perpendicular to the electric field vector are more influenced than parallel alignment, pointing towards a stronger influence on T_{ODT} for this specific orientation. These results could point towards the proposed selective, orientation dependent disordering of microstructures.

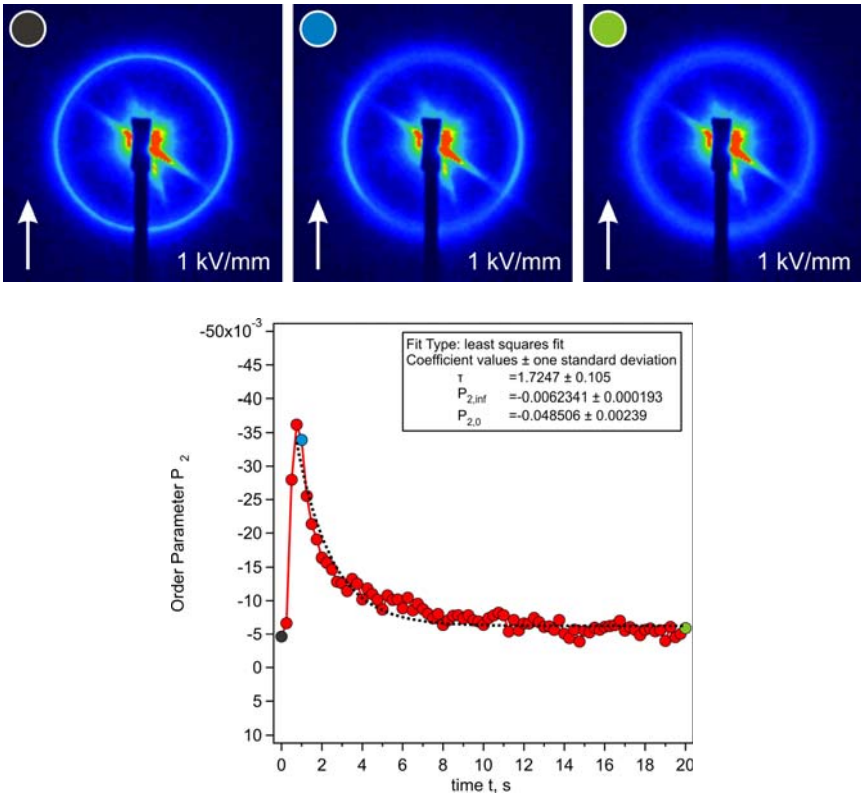

Figure 2: (top) Successive scattering patterns of a PS-b-PI solution in toluene close to the order-disorder transition. Turning the field to 1 kV/mm (arrows indicate direction of the electric field vector) suffices to first melt perpendicularly aligned lamellae / reorient them and consequently disorder the microphase. (bottom) The order parameter P_2 describes the degree of anisotropy in the pattern, and thereby quantifies the degree of orientation. This plot corresponds to the top scattering patterns and shows how initially order/orientation increases before it quickly decreases again due to the sample disordering.