Seminar

Prof. Michael Wübbenhorst

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Ultrathin polymer films: sensing polymer dynamics and chain perturbations on multiple length scales by dielectric relaxation spectroscopy

Despite 15 years of extensive research, the glass transition of ultrathin polymer films (L < 100 nm) is still a subject of deep controversy. While a vast majority of studies has revealed substantial changes in the glass transition temperature (Tg) of e.g. polystyrene (PS), there are a few research groups claiming that there is basically no “confinement” effect in ultrathin polymer films down to a few nm in thickness.

This presentation discusses various mechanisms that might affect the glass transition dynamics in ultrathin polymer films. Starting from early concepts such as end-group segregation, free volume arguments or De Gennes sliding mode, we will try to identify relevant types of “confinement induced” perturbations and their implication for the segmental dynamics.

Based on dielectric relaxation spectroscopy (DRS), capacitive dilatometry, and advanced (dielectric) probe and labeling strategies, we will address the following issues:
Mobility profiles of the segmental dynamics across the film thickness as deduced from the thickness dependences of the dielectric strengths and the mean relaxation time.
The role of conformation perturbations (trans-gauche ratio) on Tg in relation to (non)equilibrium states during film preparation and subsequent thermal treatment.
The specific role of surface induced polymer configurations at the solid-polymer interface (adsorbed layer) and a free polymer surface. Here, particular attention will be paid to the evolution and impact of an irreversible adsorbed polymer “monolayer”.
Summarizing the particular findings we will present a comprehensive physical picture of ultrathin polymer films taking into account both features of the polymer solution history (casting and drying process) and the evolution of a density and mobility profile driven by polymer adsorption and reorganization at the solid-liquid interface.

Wednesday, April 25th, 14h00

Hörsaal Makromolekulare Chemie, Stefan-Meier-Str. 31

Invited by: Prof. Günter Reiter

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