CPP 24 Polymer films II

Zeit: Dienstag 15:15–16:15 Raum: TU C130

CPP 24.1 Di 15:15 TU C130

Calorimetric Glass Transition in Polystyrene Films of Nanometer Thickness — •Heiko Huth, Alexander Minakov, and Christoph Schick — Universität Rostock, Institut für Physik, Universitätsplatz 3, Rostock 18051

We investigated a series of thin polystyrene films in the range of 50 nm down to 4 nm. The films are produced by spin coating. The thickness was measured by capacitance measurements using films produced under the same conditions. The AC-calorimetric investigations were done by a new calorimeter, which has the sensitivity to measure samples below one nanogram or heat capacities below 1 nJ/K, respectively. A detailed description of the method is given in another paper. The calorimetric measurements were done under the same condition for all samples of the series. The second heating and cooling curve obtained at 40 Hz and 2 K/min was used. We do not find any influence of film thickness on the glass transition temperature down to 4 nm. There are only changes in curve shape for the thinnest films. This shows that we really measure thin films and not droplets of the sample due to dewetting.

CPP 24.2 Di 15:30 TU C130

Mechanical spectroscopy of polymer films of reduced dimensions and with different cross-linking degree — •Tatjana Haramina, Hans-Georg Brion, and Reiner Kirchheim — Institut für Materialphysik, Uni-Göttingen, Friedrich-Hund-Platz 1, D-37077 Göttingen

Anelastic behaviour of a material is caused by different motions in material. The time lag between the stress and the strain, anelasticity, influences the damping of the material. This can be observed by means of mechanical spectroscopy.

Dynamics of the supported thin polymer films differs from that of the bulk polymers due to the surface contribution as well as the substrate-film interface contribution. We study the glass transition of thin polystyrene films on silicon substrates. The mechanical spectra show the shift of the glass transition temperature to lower values and broadening of the transition width, which is consistent with the idea of liquidlike layer on the surface and of an interaction between film and substrate.

Additionally the Poly(vinyl cinnamate) films on silicon substrates are studied. With an increase in the degree of cross-linking the glass transition becomes weaker and shifts to the higher temperatures. These changes in the mechanical spectra prove the decrease of the molecular mobility caused by the photo-cross-linking.

CPP 24.3 Di 15:45 TU C130

Simulations of Lateral Grating Formation Using Finite Element Method — •P. Mirzoyan, M. Saphiannikova, K. Morawetz, O. Henneberg, and U. Pietsch — Institut für Physik, Universität Potsdam, Am Neuen Palais 10, D-14469 Potsdam

The elastic response of a polymer films containing azobenzene groups has been investigated at the presence of a laterally periodic external force using linear elasticity theory in terms of the finite element (FEM) approach. In particular we are interested to understand the formation of a lateral grating structure in the film, if the azofilm is covered by another polymer film, which is not affected by the external force. We have shown, that the strength of the buried lateral grating depends on the layer thicknesses and on the ratio of share elastic constants of the top layer(1) and azolayer(2). Using Young‘s moduli $E_1 = 2GPa$ and $E_2 = 1GPa$, Poisson‘s ratio $v = 0.4$, mass density $\rho = 1.05g/m^3$, and thicknesses $h_1 = 300nm$, $h_2 = 100nm$ one can find a completely planar surface of the bi-layer structure with a buried grating in the azo-layer.

The existence of such a system could be confirmed by the experiment.

CPP 24.4 Di 16:00 TU C130

NONEQUILIBRIUM CONFORMATIONS OF SINGLE ADSORBED POLYMER CHAINS — •Christof Ecker and Jürgen P. Rabe — Institut für Physik, Humboldt-Universität zu Berlin, Newtonstr. 15, 12489 Berlin

Using Scanning Force Microscopy (SFM) single molecules adsorbed onto a flat surface can be imaged often with a resolution high enough to track the chain contours. This opens the possibility of polymer experiments on a single molecule base. In an earlier study it was found that conformations depend critically on the chain mobility on the surface [1]. A high mobility allows relaxation to the thermal equilibrium where chains can be described e.g. by the worm-like chain model. A low mobility on the other hand leads to a trapping of chains so that the conformations formed upon adsorption are preserved.

In my talk I will discuss the kinetics of chain adsorption onto low mobility surfaces and how the kinetics are related to the formed conformations. I will present results of MD simulations and also of SFM experiments. In the latter, two kinds of polymer systems were investigated: dendronized polymers [2] and double stranded DNA. The conformational characteristics observed are (1) sinusoidal undulations and (2) spirals. Both can be explained in the picture of a zipping process [3] as confirmed by the simualtions.

[1] Rivetti et al., J. Mol. Biol. 264, 919 (1996). [2] L. Shu et al., Macromolecules 33, 4321 (2000). [3] A. L. Ponomarev et al., Macromolecules 33, 2662 (2000).