CPP 19 Dynamics I

Zeit: Dienstag 09:45–11:00 Raum: TU C230

CPP 19.1 Di 09:45 TU C230

Dynamical Scaling of Single Chains on Adsorbing Substrates: Diffusion Processes — •Radu Descas[1,2], Jens-Uwe Sommer[2], and Alexander Blumen[1] — [1]Theoretische Polymerphysik, Universitaet Freiburg Hermann-Herder-Strasse 3, Freiburg, Germany — [2]Institut de Chimie des Surfaces et Interfaces, 15, rue Jean Starcky, Mulhouse Cedex, France

We present MC simulations of tethered chains of length N on adsorbing surfaces, analyzing the results using scaling arguments. We investigate the dynamical scaling behavior at the adsorption treshold, ϵ_c, by focusing on the end-to-end correlation function [1] and on the mean-square displacement of different monomers of the chain [2]. We find that at ϵ_c the dynamic scaling exponent a (which describes the relaxation time of the chain as a function of N) is the same as that of free chains. For $\epsilon > \epsilon_c$, the time scale for the relaxation in the direction perpendicular to the surface, $\tau_\perp$, becomes independent of N; $\tau_\perp$ is then the relaxation time of an adsorption blob. In the direction parallel to the surface the motion is similar to that of a two-dimensional chain and is controlled by a time scale given by $\tau_\parallel \sim N^{2\nu_2+1}L^{-2\Delta\nu/\nu}$, where ν_2 is the Flory exponent in two dimensions, ν is the Flory exponent in three dimensions and $\Delta\nu = \nu_2 - \nu$. [1] R Descas, J. -U. Sommer and A. Blumen, J. Chem. Phys 120, 8831, 2004. [2] R Descas, J. -U. Sommer and A. Blumen, to be published.

CPP 19.2 Di 10:00 TU C230

Intrastack rotation in pyrene hexafluoroarsenate — •S. Matejcek and E. Dormann — Physikalisches Institut, Universität Karlsruhe (TH), D-76128 Karlsruhe, Germany

The specific heat of the quasi-one dimensional organic conductor pyrene hexafluoroarsenate ($(Py)_7(Py)_4(AsF_6)_4{\cdot}4CH_2Cl_2$) was measured between 10 K and 250 K using the method of continuous heating. The contribution of the lattice to the specific heat was modelled using the Debye-model and Einstein terms. The variation of the specific heat at the structural phase transition that is accompanied by 60° rotation of one of the stacked pyrene molecules could well be reproduced using a cooperation model including the formation of domains, and the surprisingly high transition entropy was explained qualitatively.

CPP 19.3 Di 10:15 TU C230

Pattern formation in thin polystyrene films — •Anatoli Serghei[1], Heiko Huth[2], Christoph Schick[2], and Friedrich Kremer[1] — [1]University of Leipzig, Institute for experimental physics I, Linnestr. 5, 04103 Leipzig — [2]Universität Rostock, Fachbereich Physik, Universitätsplatz 3, 18051 Rostock

Thin polystyrene films (ranging from 30 nm to 300 nm, prepared in a sandwich geometry between two Aluminum electrodes) exhibit in ambient air at temperatures above the glass transition (i.e. 180 C) a pattern formation, while in a pure nitrogen atmosphere and in vacuum their geometry remains unchanged. This finding indicates an enhanced sample mobility in ambient air in comparison to that in a nitrogen atmosphere or in vacuum. As proven by Broadband Dielectric Spectroscopy, capacitive dilatometry and temperature modulated calorimetry, this effect is caused by an increase in time of the average relaxation rate of the dynamic glass transition and a corresponding reduction of the glass transition temperature Tg. Measurements by Infrared Spectroscopy reveal that the origin of this phenomenon is a decrease of the average molecular weight as a consequence of oxygen-induced chain scissions in ambient air.

References: P. J. Yoo and H. H. Lee, Phys. Rev. Lett 91, 154502 (2003) N. Bowden et al., Nature 393, 146 (1998) K. Dalnoki-Veress, B. G. Nickel, and J. R. Dutcher, Phys. Rev. Lett. 82, 1486 (1999)

CPP 19.4 Di 10:30 TU C230

Studium der Fluordynamik in schnellen Ionenleitern vom LaF_3-Typ mit Methoden der Kernspinresonanz — •Oliver Lips, Patryk Gozdz, Danuta Kruk, Alexei Privalov und Franz Fujara — Institut für Festkörperphysik, TU Darmstadt, Hochschulstr. 6, 64289 Darmstadt

Mit Hilfe der Kernspinresonanz (NMR) lassen sich dynamische Prozesse auf verschiedenen Zeit- und Längenskalen untersuchen. Relaxationsmessungen und NMR-Spektren liefern Aussagen über lokale Bewegungsprozesse, während mit der Gradienten-NMR Transportprozesse auf mesoskopischen Skalen (nm-μm) beobachtet werden können. Insbesondere die Frequenzabhängigkeit der Spin-Gitter Relaxationszeit T_1 liefert wertvolle Informationen über mikroskopische Bewegungsprozesse, vorausgesetzt der zugängliche Frequenzbereich ist hinreichend groß. Dies kann durch Verwenden der Field-Cycling-Technik erreicht werden.

Die Kombination von mikroskopischen und mesoskopischen NMR-Techniken wurde zur Untersuchung der Fluorbewegung in festen Elektrolyten vom LaF_3-Typ eingesetzt. Es werden die zur Analyse der Field-Cycling Daten notwendigen Modelle, sowie die Ergebnisse für verschieden dotierte Proben vorgestellt.

CPP 19.5 Di 10:45 TU C230

Slow Cation Exchange Processes in Polycrystalline Lithium Orthosilicate Probed by Two-Time ^{7}Li Stimulated-Echo NMR Spectroscopy — •Martin Wilkening and Paul Heitjans — Universität Hannover, Institut für Physikalische Chemie und Elektrochemie

Li diffusion in the low-temperature modification of Li_4SiO_4 is investigated by two-time ^{7}Li stimulated-echo NMR spectroscopy. Slow Li motions are directly monitored between 300 K and 433 K by recording spin-alignment echoes as a function of mixing time t_m varying over six decades from 10^{-5} s to 10 s. In this temperature range the decay curves show biexponential behaviour: Whereas the decay step at short t_m is directly induced by ionic jumps between crystallographically different Li sites, the decay step at longer t_m indicates spin-alignment decay simply due to (quadrupolar) longitudinal relaxation. The frequency independent decay rates τ^{-1} ($50\ s^{-1} \leq \tau^{-1} \leq 7800\ s^{-1}$) show Arrhenius behaviour with an activation energy of 0.52(1) eV and a preexponential factor $\tau_0^{-1} = 1.5(1) \cdot 10^{10}\ s^{-1}$. Extracted jump rates and activation energies for Li diffusion are in good agreement with those obtained by one- and two-dimensional ^{6}Li exchange (rotor synchronized) MAS-NMR [1].

[1] Z. Xu and J.F. Stebbins, Science **270**, 1332 (1995).