Polymers under Multiple Constraints

Polymer- & Soft-Matter-Seminar

Tuesday, 7th January 2020

at: **5.15pm**

VDP4 1.27, Von-Danckelmann-Platz 4, 06120 Halle

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"Molecular view on polymers adsorbed on nanoparticle surfaces"

The outstanding performance of modern elastomers is dominated by the reinforcement arising from nanometric fillers. The compounds' peculiar thermo-mechanical properties cannot be explained without consideration of an interphase, i.e., a region of polymer with modified properties [1]. Previous results support a consensus picture of adsorbed components with locally increased Tg and gradient zone of a few nm [2]. This talk focuses on more recent results, mostly obtained by proton low-resolution NMR as a probe of the segmental dynamics, that challenge the generality of this picture. In the system poly(ethylene oxide)-silica, we do find strongly immobilized (yet intrinsically mobile) components forming a layer of up to 2 nm thickness around the particles [3], but the layer thickness is temperature-independent and is governed by a non-equilibrium process in dependence of end groups [3] and preparation conditions [4], and also of the curvature of the particles. Spin-diffusion NMR experiments, which probe the size of nanometric domains with distinct mobility, indicate that the smooth-mobility-gradient picture of the "glassy layer" must be replaced by a scenario ruled by dynamic heterogeneities associated with the increased glass transition [5].

[1] A. Mujtaba et al., ACS Macro Lett. 2014, 3, 481
[2] A. Papon et al., Phys. Rev. Lett. 2012, 108, 065702
[3] Y. Golitsyn et al., J. Chem. Phys. 2017, 146, 203303
[4] S. M. Oh et al., Phys. Rev. Lett. 2019, 123, 167801
[5] H. Schneider et al., Macromolecules 2017, 50, 8598