Influence of the proximity of a solid surface on relaxation behaviour of complex systems

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With the recently developed methods REDLS (Resonance Enhanced Dynamic Light Scattering) [1-3] and WEDLS (Waveguide Enhanced Dynamic Light Scattering) [4] it became possible to study the behaviour of complex systems as nanoparticles in solution or polymer thin films in close proximity of solid surfaces. Due to the nature of the experiment the incident field has a penetration depth of the order of 100 nm to 1000 nm and is thus localized at the surface. One advantage of this experiment is the constant in situ monitoring of the system studied via the position of the surface plasmon resonance, which is very sensitive to changes of refractive index as e.g. induced by adsorption of particles or dewetting of the polymer film.

Experimental setup of REDLS and sample results for the SPR and the REDLS part

In the case of dilute dispersions the presence of a nearby surface leads to an anisotropic diffusion. In the experiments studying the anisotropic diffusion we were able to follow the onset of anisotropic diffusion depending on particle size and penetration depth used. Recently we extended our studies to ultrathin polymer films of polystyrene down to 17nm of film thickness [5] on a gold surface. The results show a clear indication of a change in the relaxation behaviour in these systems with the thickness of the film while the glass transition temperature of these films was basically unaffected. These results may shed new light on the question why some groups have seen an increase, other a decrease and some no change in the glass transition temperature.