

INFLUENCE OF THE POLYDISPERSITY OF TWO POLYSTYRENE MATRICES FILLED WITH NANOSILICA PARTICLES ON THEIR MELT ELASTICITY

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It has been shown recently that the linear elastic steady-state compliance J_e^0 very sensitively reacts on the addition of nanoparticles to a polymer melt [1-3]. This effect can be related to an interaction between the particles and the matrix molecules. Creep-recovery experiments have evolved to a very suitable tool to measure this quantity as the time window can be extended widely enough to detect the processes underlying the interactions. Whereas the effect of the particle geometry on J_e^0 has already been investigated to some extent [3], the influence of the matrix is still an open question. Therefore, in this study the results on two polystyrenes, with different molecular structures and composites with 1 vol.% nano silica each are reported. One of the polystyrene is an anionic sample (aPS) with a narrow molar mass distribution, the other a radically polymerized one (PS 158K) with a broader molar mass distribution. Due to their different molecular structures the unfilled polymers already differ significantly in their rheological properties. The linear steady-state elastic compliance is found to be $J_e^0 = 2 \cdot 10^{-5} \text{ Pa}^{-1}$ for the aPS, and $J_e^0 = 2.5 \cdot 10^{-4} \text{ Pa}^{-1}$ for the PS 158K, which is in agreement with the literature.

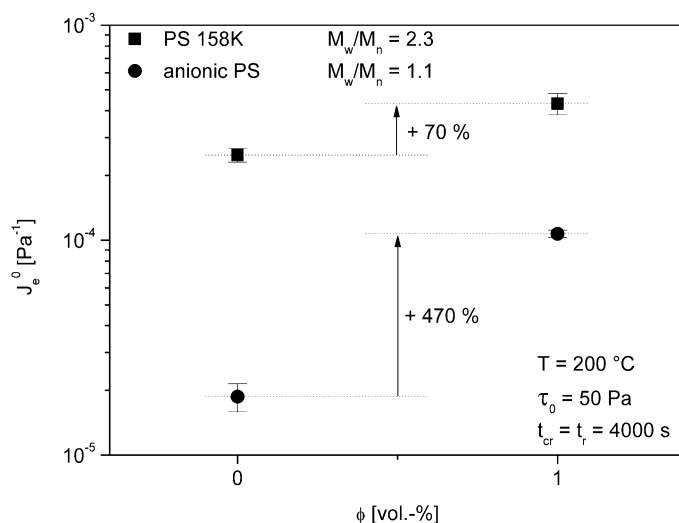


Fig. 1 Steady-state recoverable compliances J_e^0 of an anionic and a radically polymerized polystyrene and composites with 1 vol.% nano silica each

158K an increase of J_e^0 of only 70% is found it is much larger, namely 470% in the case of the anionic PS (cf. Fig. 1). The interaction between the polymer and the nanoparticles will be discussed as the origin of the elasticity increase. Furthermore, results on the stress dependence of J_e^0 will be reported and conclusions drawn.

- [1] Münstedt, H.; Katsikis, N.; Kaschta, J.: *Macromolecules* 41, 9777-9783, 2008.
- [2] Münstedt, H.; Köppl, T.; Triebel, C.: *Polymer* 51 (1), 185-191, 2010.
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Investigations on nano composites with a poly (methyl methacrylate) of $M_w/M_n = 1.5$ as the matrix have shown, that this elasticity, measured by J_e^0 in the creep-recovery experiment, strongly increases with the specific surface area of the nanoparticles added [2]. Also for the PS composites an increase of J_e^0 was found by adding only 1 vol.% of nano-silica particles. However, the relative increase is strongly dependent on the basic elasticity of the unfilled matrix. Whereas for the PS