Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Anomalous diffusion of a polymer chain in an unentangled melt JEAN FARAGO, Universite de Strasbourg, HENDRIK MEYER, ALEXANDER SEMENOV, CNRS — Contrary to common belief, the hydrodynamic interactions (HI) in polymer melts are not screened beyond the monomer length and are important in transient regimes. We show that the viscoelastic HI effects (VHI) lead to anomalous dynamics of a tagged chain in an unentangled melt at $t < t_N$ (t_N, the Rouse time). The chain centre-of-mass (CM) mean-square displacement is enhanced (as compared to the Rouse diffusion) by a large factor increasing with chain length. We develop an analytical theory of VHI-controlled chain dynamics yielding negative CM velocity autocorrelation function which quantitatively agrees with our MD simulations without any fitting parameter. It is also shown that the Langevin friction force, when added in the model, strongly affects the short-t CM dynamics which, however, can remain strongly enhanced. The transient VHI effects thus provide the dominant contribution to the subdiffusive CM motion universally observed in simulations and experiments on polymer melts.

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Date submitted: 11 Nov 2011 Electronic form version 1.4