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Extension of cylindrical samples in the Sentmanat Extensional Rheometer (SER)

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ke (armere) med

ket medfører
i en spænding i
angen ud til
)plasten som vist på

20 MPa, et
se fylde (UK: density) på

or kun udvide sig 2% i

er effektivitets faktor (UK:
lar fiberen har en
UK: Modulus of elasticity)
ages at der er en lineær
) indtil man når
ding (UK: Yield Strength).

vor tykt skal Kevlar laget
r (dvs. P=2 bar) og et

illedet ovenfor) for at
ylinderformet med en

en af en ΔR=4mm tyk
længderetningen uden at

Is there a Relationship between the Elongational Viscosity and the First Normal Stress Difference in Polymer Solutions?

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longational viscosity and a non-zero first normal stress difference are typical characteristics of flexible c systems. The elongational viscosity of polymer solutions can be several orders of magnitude larger solvent viscosity. In contrast, the shear viscosity remains on the order of the solvent viscosity. In many ns, elongational flow affects the processability more severely, e.g., in fiber spinning, spraying, n of pesticides, etc. where the flow is elongational, at least to a large extent. However, the definition of Normal stress $N_1 = \tau_{xx}-\tau_{yy}$ (with \tau_{ab}$ the components of the stress tensor) in ow compared to the definition of the elongational viscosity $\eta_e=\left(\tau_{xx}-right)/\dot{\varepsilon}$ in elongational flow suggests the existence of a direct relation between these ties ($\dot{\varepsilon}$ is the elongational rate). From an experimental point of view, measurement gational viscosity of dilute polymer solutions is a nontrivial task and only recently a method called apillary Breakup Extensional Rheometer) became available. We investigate a variety of different lutions in shear and elongational flow. The shear flow is created in the cone-plate-geometry of a rheometer. We compare the relaxation time and the elongational viscosity measured in the CaBER st normal stress difference and the relaxation time that we measured in our rheometer. All of these ties depend on different fluid parameters - the viscosity of the polymer solution, the polymer n within the solution, and the molecular weight of the polymers - and on the shear rate. , we find that the first normal stress coefficient depends quadratically on the CaBER relaxation time factor depends on the type of polymer only, whilst theoretical considerations predict a linear on the concentration, too. Different scaling relations are presented that can help explaining our

Soft Materials Rheology studied by Diffusing Wave Spectroscopy

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e spectroscopy (DWS) is an optical technique which provides detailed information about the perties of soft materials without interacting mechanically with the sample. DWS measures the ations of laser light diffusely scattered within the sample. Via the measured intensity correlation an squared displacement (MSD) of tracer particles in the medium is obtained. The MSD is then e the storage and loss modulus (G' & G") based on the general microrheology approach. Since introduced in 1987/88 tremendous progress has been made in the filed of detector technology. hoton detectors have response times in the nano second range and quantum efficiencies above re novel optical schemes such as the "Two-Cell-Echo-Technology" provide orders of magnitude algorithm. The combination of both has substantially advanced the range of application and the DWS. Today frequencies up to 1'000'000 rad/s for moduli in the range 1-100'000 Pa are DWS. Recently the first commercial instruments based on the DWS approach have become ve discuss the most important technological advances in diffusing wave spectroscopy. We rmance of this technique on a number of viscoelastic complex fluids ranging form surfactant al (microgel) dispersions and dairy products. We discuss both the opportunities and the S.

Experimental approach to determine high frequency rheological properties of polyethylene

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The determination of the second crossover frequency and the corresponding entanglement relaxation time, tau(e), together with the entanglement modulus, G(e), can be achieved for a number of thermoplastic polymers by applying the TTS method. The knowledge of these parameters is important, because they provide a link to structural parameters like friction factor and others. In contrary, polyethylene, due to its fast crystallization below Tm and weak temperature dependence of viscosity, can be explored rheologically in limited frequency range, only. An experimental determination of the mentioned parameters was only possible for model polyethylenes, and its determination for industrial polyethylenes is missing so far. Here we characterize commercial polydisperse, as well as linear and branched, polyethylenes by expanding the frequency range utilizing new rheometers: piezoelectric- and new crystal resonator technology. We introduced high frequency rheological techniques and show how to implement these new measurements methods, and compare with polymers, for which TTS holds. This allows us to determine G(e) and tau(e) for PE for the first time. Finally we compare the obtained material parameters with simulation results.

Extension of cylindrical samples in the Sentmanat Extensional Rheometer (SER)

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Polymer extensional flow is the one of the most important deformation in polymer processing. It is the dominant deformation in melt-spinning, bottle-blowing, and roll-coating. Because the molecular structure of the polymeric system strongly influences the extension viscosity, extensional flow measurements are useful for polymer characterization. The Sentmanat extensional Rheometer[1] is an new testing platform for the study of polymers and elastomers in extensional flow. This technique employs a dual wind-up drum technique to perform an uni-axial extensional deformation during experiments. It requires small amount of materials and can be used for polymer melt and soft elastomers characterization over a very wide range of temperatures and kinematic deformations and rates. In order to validate the reliability of this testing platform a finite element technique based on a Lagrangian kinematics description of the 3D time-dependent flow of K-BKZ type fluids [2] is used to simulate extension flow of cylindrical shaped sample in the SER. Here the purpose is to discuss the potential deviations from ideal uni-axial deformation, based on theoretical ideal configurations. Our simulation can setup a theoretical based 'safe' geometry range of cylinder samples for SER experiments. Extension of a cylindrical sample shows the less inhomogeneity compared to a strip shapes sample [3]. Whereas using a sample with an initial diameter of more than 0.5mm will create a too large deviation between expected and obtained Hencky strain. Furthermore, the simulations are able to capture flow instabilities in stress relaxation, which have been experimentally observed [4]. Reference [1]. M.L. Sentmanat, Rheol Acta, 43:657--669, 2004. [2]. J.M.R. Marín, H.K.Rasmussen, J. Non-Newtonian Fluid Mech, 156 (3) , p. 177-188 [3]. K.Y, J.M.R. Marín, H.K.Rasmussen, O.Hassager, J. Non-Newtonian Fluid Mech (accepted) [4]. Y.Wang, P.Boukany, S.Wang, X.Wang, Physical Review Letters, 99, 237801 (2007)