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Symposium PO
Poster Session

Organizer: Susan J. Muller

Wednesday   5:30   Main Foyer   PO1
SQUEEZING FLOW TESTING
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Squeezing flow between two parallel plates has some advantages over rotational shear testing. In spite of the wide range of sample geometries available with rotational rheometers, there are many materials that can be tested more easily in squeezing flow. For example, greasy food doughs, soap, waxy cosmetic products tend to exhibit wall slip, unstable suspensions and gels may produce a liquid film at the boundary of the upper plate, and some fiber reinforced prepregs may not give useful data when tested in torsion. Both unlubricated and lubricated squeezing flow measurements can give meaningful data. Unlubricated tests many relate to compression molding and vacuum forming. Lubricated squeezing flows can be used to measure biaxial extensional viscosity. This is a valuable test for food doughs For this reason Rheometric Scientific, Inc. has added this mode of testing to the ARES melt rheometer. Measurements can be made at both constant force and constant linear and Hencky strain rates covering a wide range of temperatures. Unlubricated squeezing flow measurements of PDMS will be presents at this poster session. These data are analyzed by the methods suggested by Laun (Laun. H. M. Angew, Makromol. Chem. Symp.1992, 56, 55; J. Non-Newtonian Fluid Mechanics, 1998).

Wednesday   5:30   Main Foyer   PO2
SLIDING PLATE MICRO-RHEOMETRY OF POLYMER MELTS
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An experimental instrument capable of opto-mechanical studies of the rheology of thin polymeric fluid films is described. The apparatus probes the 'meso-scale' (length scales of O(μm)) and therefore bridges the gap between molecular-scale devices such as the Surface Force Apparatus (SFA) and conventional rheometers which characterize the 'bulk' rheological properties of non-Newtonian fluids. The parallel plates of the device consist of polished optical flats (flat to within lambda/4) The translating plate is mounted on a double cantilever spring system and imposing a lateral force results in a planar Couette motion within the plane of the springs provided the deflection is very much less than the lever arm. The instrument rigidity is carefully designed and calibrated to ensure it does not dominate over the sample properties - for this reason we use an electromagnetic drive system (with a speaker coil and a rare earth magnet) plus weak leaf springs. This allows us to study the static and dynamic properties of much lower viscosity materials than would be possible using piezoelectric "bimorphs". The device operates in a controlled stress mode and inductive sensors are used to track the motion of the surface. The instantaneous stress and strain can be extracted to within ±5 mPa and ±5 nm respectively for gaps in the range 1 - 50 μm. Alignment of the surfaces can be

Interox only in the other case were comparatively studied. The modification was carried out in a corotating twin screw extruder. The peroxide was added always in the same feed port. At that point, the polymer was already melted, and the monomer was well mixed in the polymer, in the case where both reactants were employed. The extrusion conditions employed ensured the complete decomposition of the peroxide. Additionally, nitrogen was used throughout the extrusion process, in order to keep an inert environment inside the extruder. Similar procedure was followed without using nitrogen to analyze its role in the polymer modification during processing. No previous studies have been found in the literature dealing with the use of different environments such as nitrogen during the functionalization via extrusion.

When peroxide was incorporated into HDPE and LDPE in a non controlled environment (air), the viscosity and the weight average molecular weight (Mw) increased due to an enhancement of the high molecular weight tails of the molecular weight distributions. However, when nitrogen was used, just a small increase in G" was obtained, as a consequence of a probable increase of long branches. The functionalization of both polyethylenes in nitrogen did not produce any changes in their rheology, while an increase in G" due to a probably increase in long chain branching resulted from the functionalization process in air. Concerning the LLDPE, a long chain branching mechanism may have taken place when peroxide was used in both environments, leading to a rise in G". Functionalization via extrusion caused an enlargement in the high molecular weight tails of the distribution, specially in air, which in turn led to higher values of η_o and G".

Wednesday   5:30   Main Foyer   PO13
PRESSURE CHARACTERISTIC FOR NON-ISOTHERMAL FLOW OF THE THERMOPLASTIC POLYMERS MELTS IN CIRCULAR CONFUSER
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Melts of some polymers within the alteration of processing parameters are alike high-viscosity liquids with Arrhenius dependence of viscosity on temperature, their flow takes place in condition of the big gradients of the temperature and viscosity. Therefore it is necessary with investigation of such fluid flows to take into account both dissipation and heat exchange at boundary of confuser. To solve this conjugated problem the region of flow is separated into N concentric conical layers in confuser and it is assumed that viscosity over cross-section of each layer is constant and equal to one taking for average temperature over cross-section of this layer. Owing to this method the set of equations of motion and heat transfer is reduced to the set N+1 ordinary differential equations for the mean temperatures in layers and mean pressure and analytical expressions for components of velocity, dissipation function and heat transfer coefficients between layer. The effects connected with the dissipation of mechanical energy become dominated on some distance from entrance. It carries out to appearance of small viscosity high-temperature shear layer and to the pressure gradient which is less than for isothermal flow. On small flow rate the pressure characteris-tic is linear for adiabatic flow. With increase of flowrate the small viscosity layer appears at the exit from confuser in consequence of mechanical energy dissipation. The pressure gradient on the exit is considerably decreased in comparison with the isothermal flow that leads to nonlinear pressure drop-flowrate dependence. For confusers with small angle of opening high-temperature shear layer will have been extended almost on all confuser beginning in some flow rate. The pressure drop for this flow is decreased beginning and pressure characteristic with the flow of melts of thermoplastic polymers is non-monotonous. Pressure drop-flowrate dependence was investigated for different intensity of heat exchange with ambient too.

Wednesday   5:30   Main Foyer   PO14
A NEW MODEL FOR THE AMORPHOUS PHASE OF POLYMERS
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We review the present understanding of the properties of the amorphous phase of polymers, below Tg, above Tg and in the melt, and find it incompatible with abundant and confirmed experimental evidence by Low Raman spectroscopy, SAXS, Thermal Stimulated Current, specific volume, DNS, NMR, Brilloin scattering etc., which point to the existence of an inhomogeneous packing density at least at the nanometric scale, and which we postulate results from the interactive coupling between the bonds belonging or not to the same macromolecules. We show that