New developments for the mechanical characterization of materials

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Rheology as a science of flow of matter is highly influenced by the topology and morphology and of the investigated polymer molecules and fillers. Within this presentation three current developments within our group will be presented. In the first part, the direct influence of molecular structure on the non-linear mechanical properties and the processing will be presented. In a second part, rheological methods, e.g. elongation rheology or non-linear shear (especially FT-Rheology, see Fig.1) are further developed. Finally the combination of rheological measurements with a second characterization method (NMR, X-ray, dielectric spectroscopy etc.) is described. These new developments gain unique information about molecular dynamic and structure of time and shear dependant phenomena, e.g. the effect of fillers within polymers.

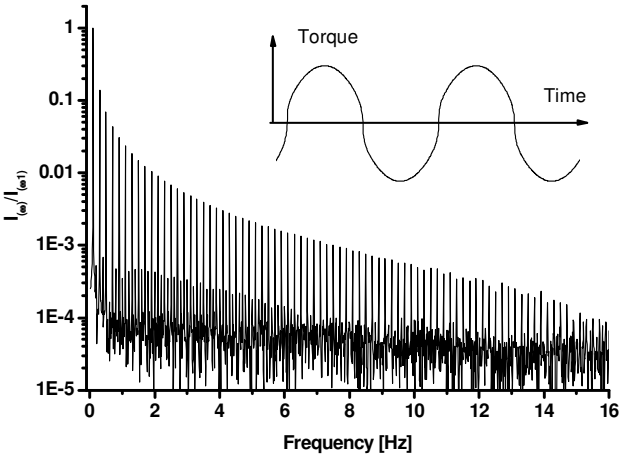

Fig. 1. Measurement of the time dependant torque in a rheometer. The sample was a water-in-oil emulsion and a shear excitation of 0.1 Hz was applied. The FT-Rheology spectrum of the torque allows the quantification of the non-linearity via the odd higher harmonics of the fundamental up to about the 151-th of the excitation frequency.

References

1) M. Wilhelm, Fourier-Transform Rheology, *Macromol. Mater. Eng.* **287** 83 (2002)

2) K. Hyun, M. Wilhelm, Establishing a New Nonlinear Coefficient Q from FT-Rheology, first investigations on entangled linear and branched Polymer melts, *Macromolecules* **42** 411 (2009)