ELECTRO-RHEOLOGICAL FLUIDS CHARACTERISATION BY DYNAMIC MECHANICAL THERMAL ANALYSIS UNDER APPLIED FIELDS

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ABSTRACT

Electro-rheological fluids increase viscosity under high electric fields and are of great interest for variable mechanical torque transmission (electrical clutch) but of course have potential applications for variable controlled damping. The electro-viscous effect can be achieved in two different ways:

1. Structure build-up under electric field
2. Introducing a relaxation process of the same timescale of the motion to be coupled.

Mechanism (1) will be inherently mechanically non-linear/non Newtonian whilst (2) can in principle be linear visco-elastic.

The torsional rheometer head for the PL-DMTA has been used in this work in the oscillating mode with parallel plate geometry. The parallel plate configuration allows uniform high voltage to be applied across the sample during measurement of the visco-elastic characteristics. Cone and plate geometry does not allow application of a uniform electric field and has not been utilised in the present work. Type (1) and (2) systems have been studied as a function of temperature oscillation frequency and applied voltage. Results are reported in terms of a tan δ and shear dynamic shear moduli.

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