

Corrections

The BKZ as an alternative to the Wagner model for fitting shear and elongational flow data of an LDPE melt

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Rheol. Acta, 23, 10–13 (1984)

It was claimed that a separable BKZ model, with a potential function given in Eq. (21), fits the damping function in uniaxial extension and shear for Melt I, as well as the Wagner model fits these damping functions. The plot of the fit for uniaxial extension, figure 2 of Larson and Monroe, however, is in error; the fit is actually poor. A potential function, u , that *does* yield a good fit, not only to shear and uniaxial extensional data, but to biaxial [1] as well, is

$$u = \frac{3}{2\xi} \log \left[1 + \frac{\xi}{3} (I - 3) \right], \tag{1}$$

where

$$\xi \equiv c_0 + c_2 \operatorname{atan} \left[\frac{c_1 (I_2 - I_1)^3}{1 + (I_2 - I_1)^2} \right] \tag{2}$$

and

$$I \equiv (1 - \alpha) (I_1 - 3) + (1 + 2\alpha (I_2 - 3))^{1/2} + 2 \tag{3}$$

with $c_0 = 0.20$, $c_1 = 0.05$, $c_2 = 0.121$, and $\alpha = 0.1$. I_1 and I_2 are the first and second invariants of the Finger strain tensor. The damping functions calculated from this potential function are compared to the experimental damping functions in figure 1. The correct amount of strain softening is predicted for all three types of deformation; the Wagner damping function fitted to uniaxial extension predicts too much strain softening in biaxial extension [2].

The Wagner model also predicts a zero second normal-stress difference. Eqs. (1–3) give a negative second normal-stress difference; the predicted ratio of

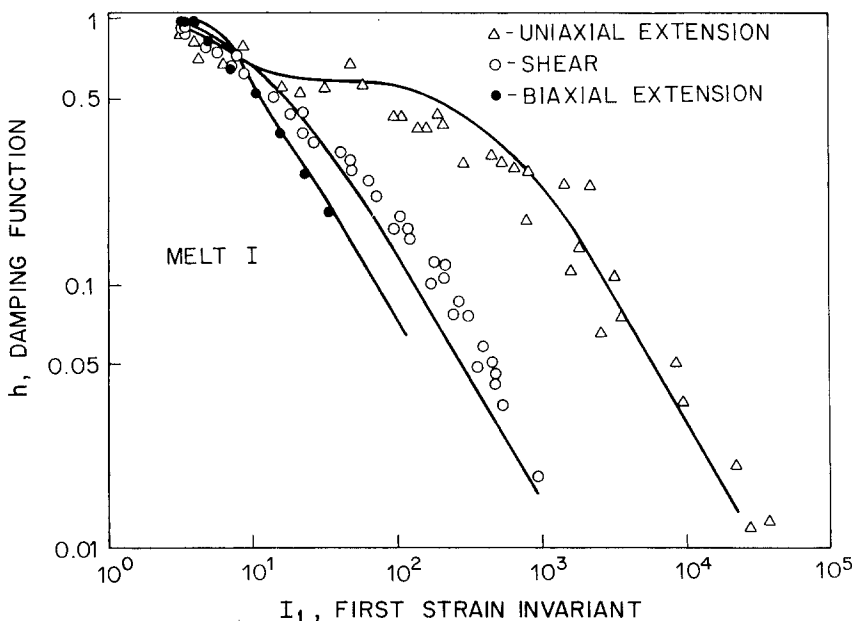


Fig. 1. Measured damping function (symbols) for Melt I compared to the damping function calculated (lines) from Eqs. (1–3)

second to first normal-stress differences decreases in magnitude from -0.11 at low shear rates to near zero at high shear rates. The magnitude of the second normal-stress difference, N_2 , is roughly proportional to the value of the parameter, α . For moderate and large I_1 , $h_{biax} < h_{uniax}$. There is, however, a predicted region at small I_1 in figure 1, where $h_{biax} > h_{uniax}$. Such a region *must* occur at small strains if N_2 is negative. The size of this region grows with α and hence with the magnitude of N_2 . The experimental data in Fig. 1 indicate that the size of this region is small, which is consistent with a small magnitude for N_2 .

References

1. Khan SA, Prud'homme RK, Larson RG (1987) *Rheol Acta* 26:144
2. Soskey PR, Winter HH (1985) *J Rheol* 29:493

(Received December 23, 1986)

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