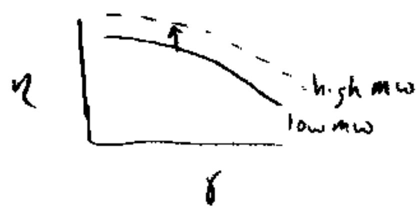
Rheology Quiz

1.) Broadening the molecular weight distribution results in greater shear thinning.

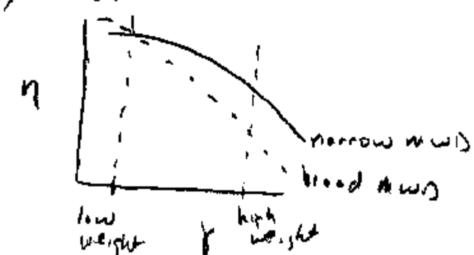
Increasing the molecular weight of the polymer shifts the viscosity curve to higher viscosities



Note that

$\eta \propto \text{constant } M_w^{3.4}$

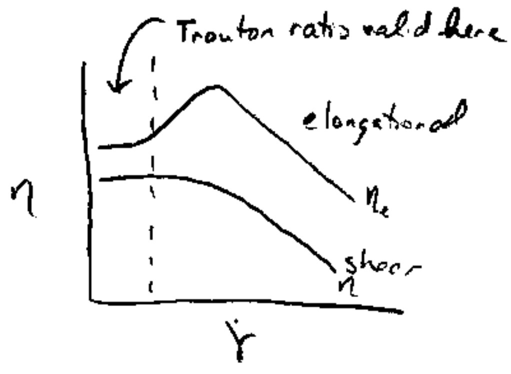
2.) Test the melt index for each polymer with two different weights (shear rates). Those two melt indicies would be represented in the following way on a viscosity curve:



Note: $\eta \propto \frac{1}{MI}$

The greater the ratio of the high weight to the low weight MI is representative of the broader molecular weight distribution

3)



The relationship between the elongational and shear viscosities for a Newtonian fluid is known as the Trouton ratio where:

$$\frac{\eta_e}{\eta} = 3$$

It is only valid at low shear rates.

4.)

$$\eta = \eta_{ref} \exp(-b\Delta T)$$

where $\Delta T = T - T_{ref}$ and $0.01 < b < 0.1\ °C^{-1}$

b must be determined experimentally, but for most commercially available polyolefins, $b \sim 0.015\ °C$

5.) Measure the melt index of the polymer with two different loads, labeled as high load (HL) and low load (LL). Also measure the MI (load of 2.16 g) and HLMI (load of 10 g or 21.6 g).

Calculate m and n by:

$$n = \frac{\log(HL) - \log(LL)}{\log(HLMI) - \log(MI)}$$

$$m = \frac{8982\,(LL)}{\left[\left(\frac{1838}{\rho}\right) MI\right]^{n}}$$

where ρ is the density in SI units.