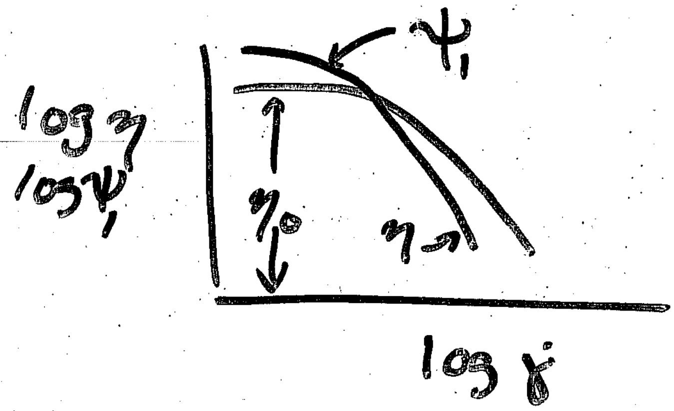
27 Feb 09 (1)

CHAPTER 6 – material for exam 2

1. Linear Polymers

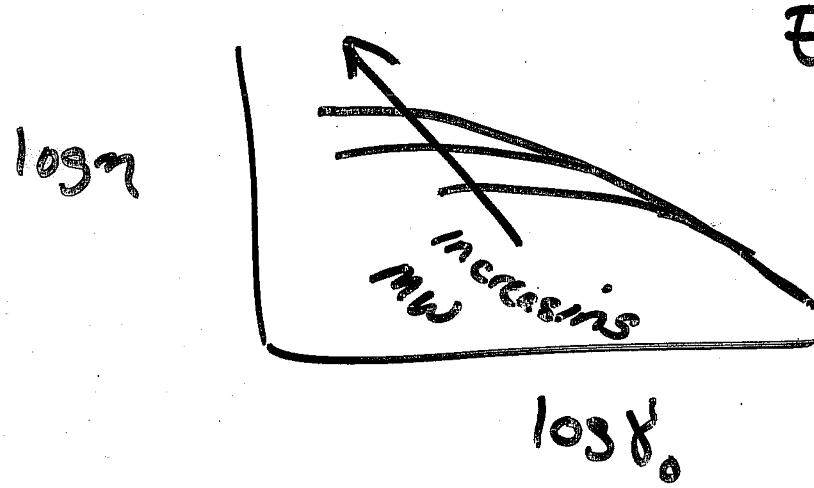


Points:
- η and Ψ_1 change over several orders of magnitude
- both tend to shear thin

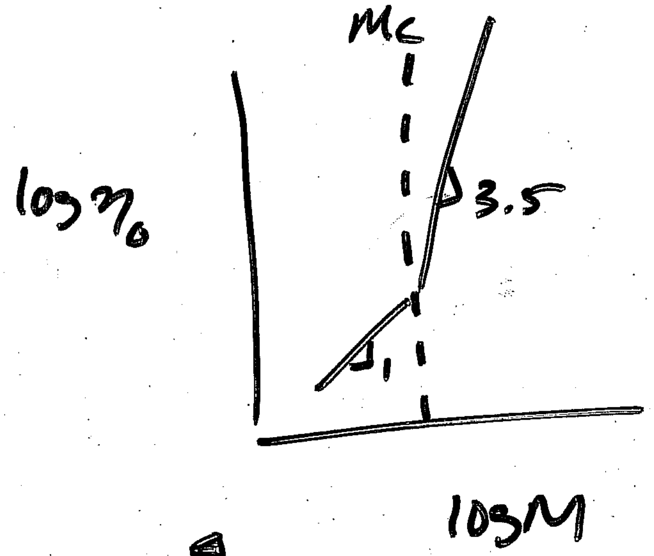
η_0 = zero shear viscosity

(2)

Effect of M



points:
- there is a low $\dot{\gamma}$ plateau
- this plateau rises w/ increasing M

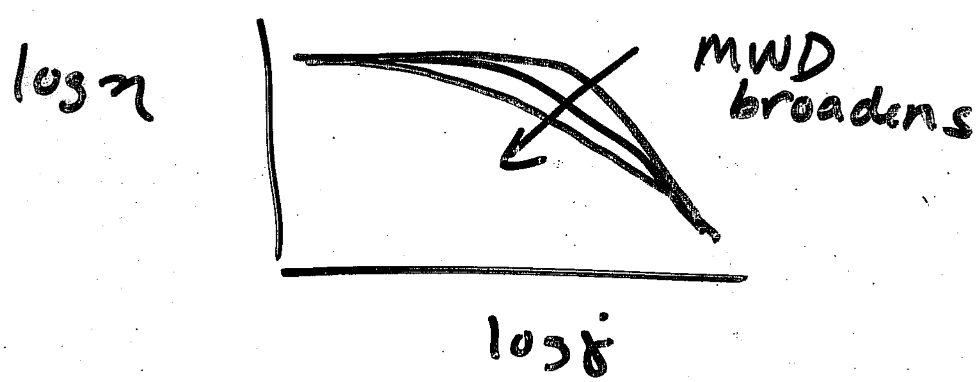


Mc = critical MW for entanglement

points:
- $\eta_0 \propto M^1$ $M < M_c$
- $\eta_0 \propto M^{3.4}$ $M > M_c$

For monodisperse polymer melts
(one molecular wt in sample)

Effect of broadening the Molecular weight distribution



Effect of Branching — is to make flow more difficult
(hard to untangle)

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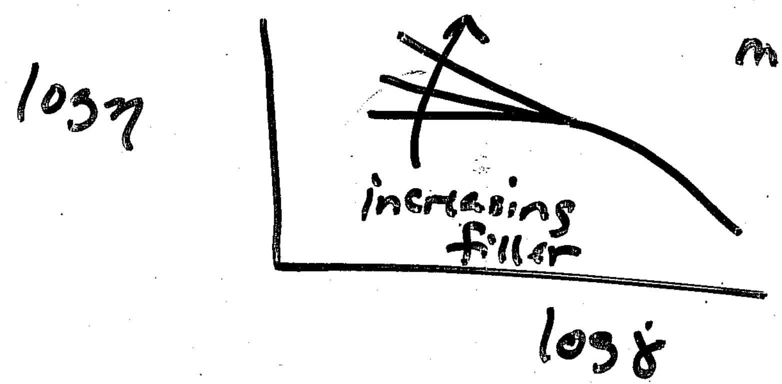
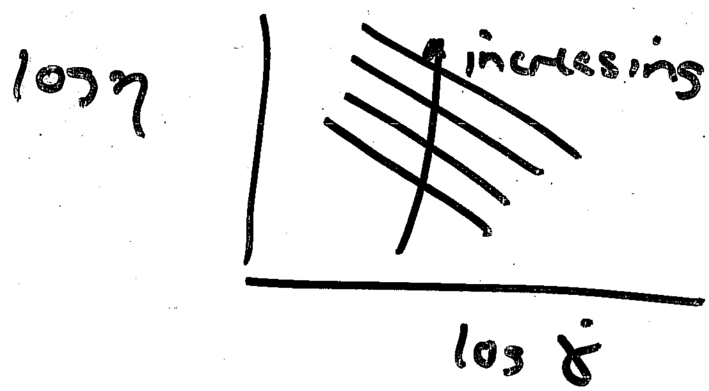
Effect of adding filler:



modest concentrations



high concentrations

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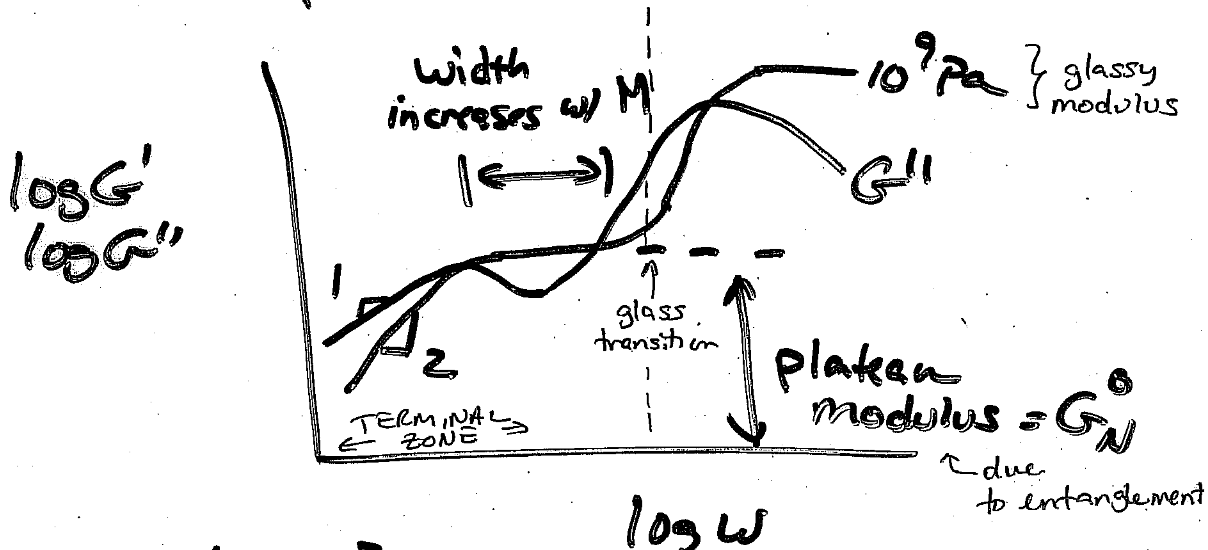
SAOS of linear polymers



$G' \propto \omega^2$ at low ω

$G'' \propto \omega^1$ at low ω

entangled mat'ls show G_N^0

Cox - Merz Rule

$$\eta(\dot{\gamma}) = \left(\eta^*(\omega)\right)\Big|_{\omega=\dot{\gamma}}$$

η ← viscosity

η^* ← complex viscosity

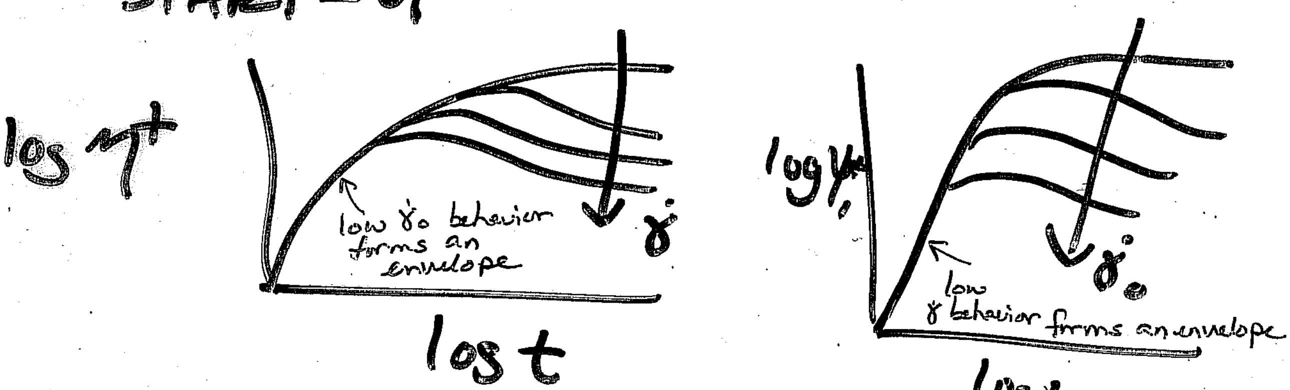
$\dot{\gamma}$ ← s^{-1}

ω ← in $\frac{\text{radians}}{s}$

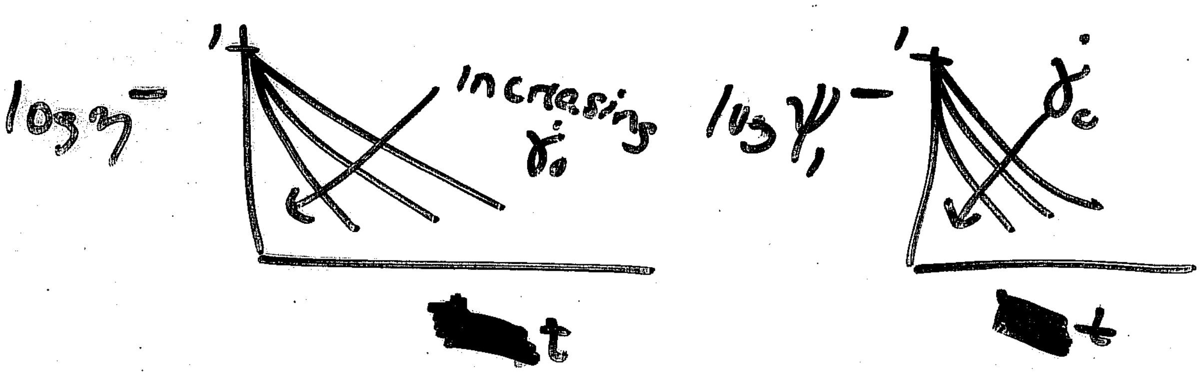
NOTE: 2π radians / cycle

Hz = cycles / second

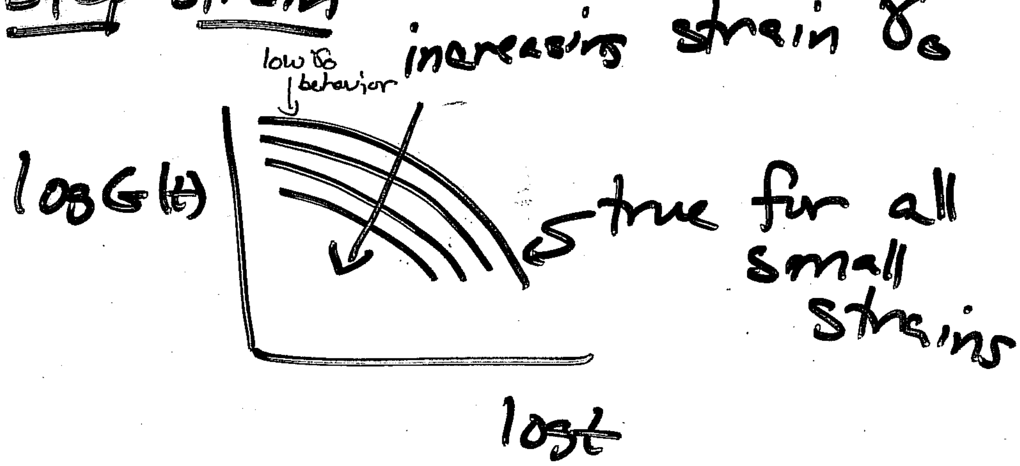
START-UP



CESSATION



Step Strain



ELONGATIONAL FLOW

- all the same types of material functions
- for linear polymers $\bar{\eta} = 3\eta_0$ (low $\dot{\gamma}$)
- difficult to measure
- industrially important due to strong stretching in industrial flows.

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