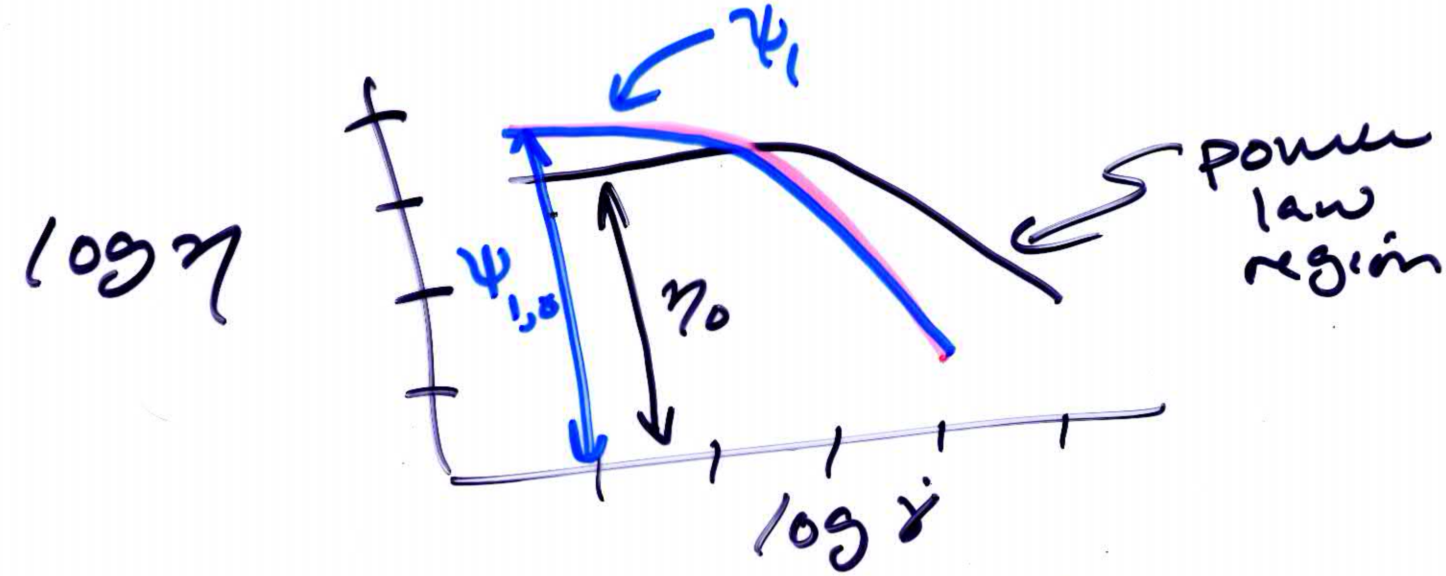
Chapter 6 - Material Behavior

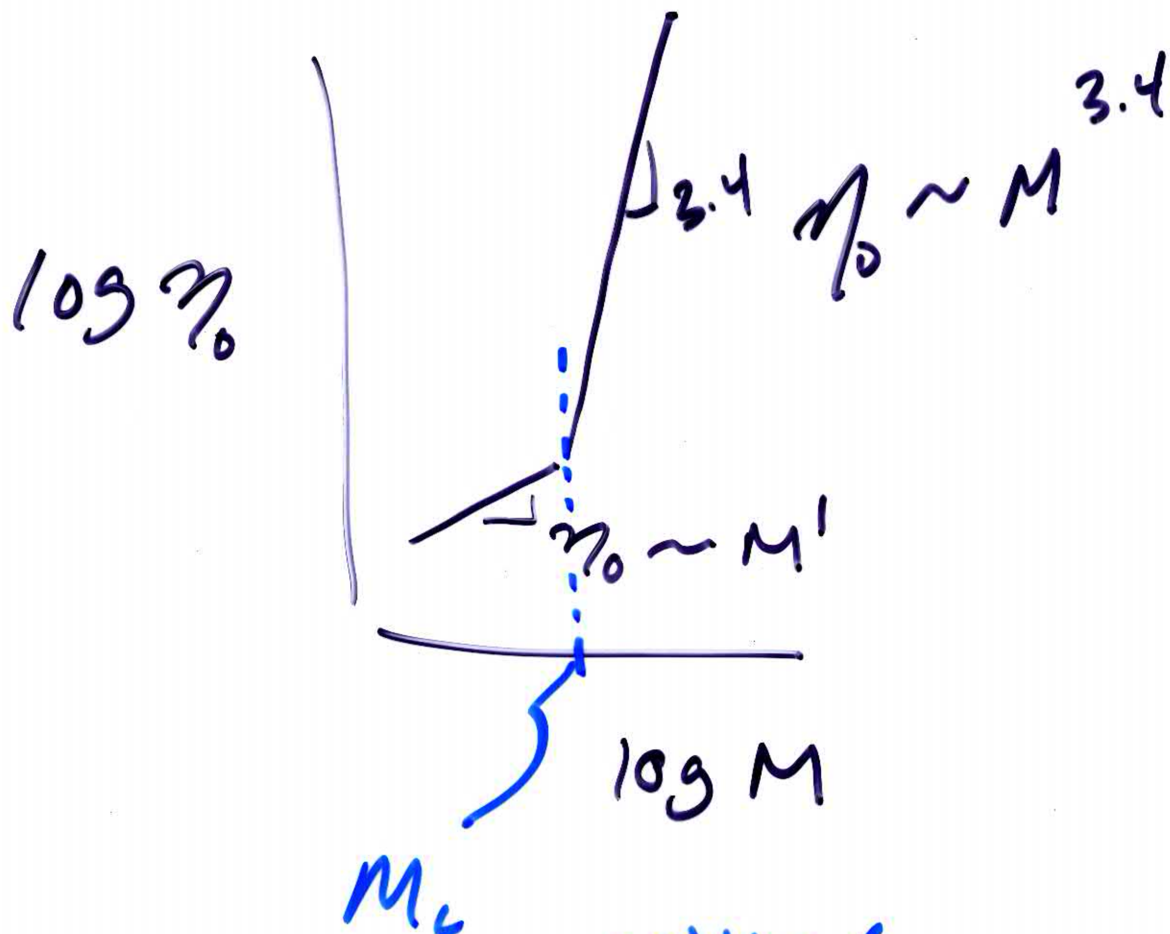
STEADY SHEAR

- linear Polymers



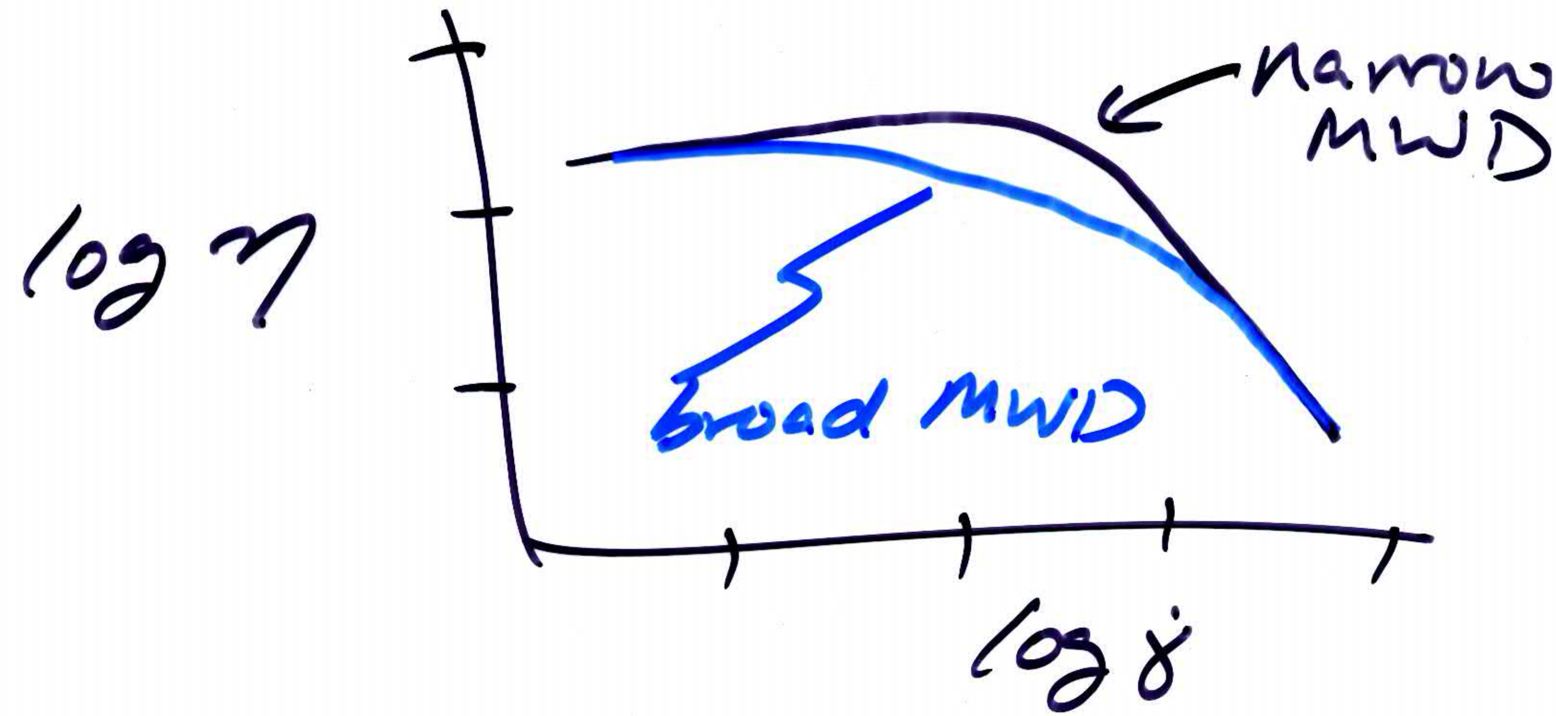
η_0 - zero-shear viscosity

$\Psi_{1,0}$ zero-shear 1st normal coef



M_c = critical molecular weight for entanglement

- Effect of Molecular Wt Distribution (MWD) on steady shear viscosity



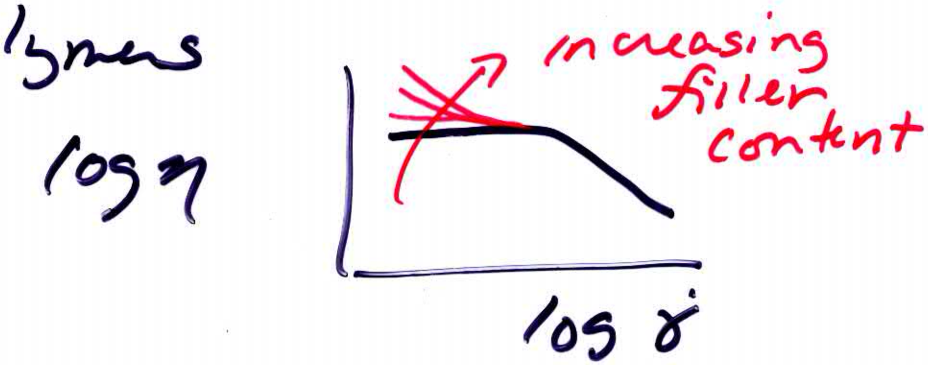
STEADY SHEAR

- other architectures
  (not linear polymers)

It is a significant
effect (see text)

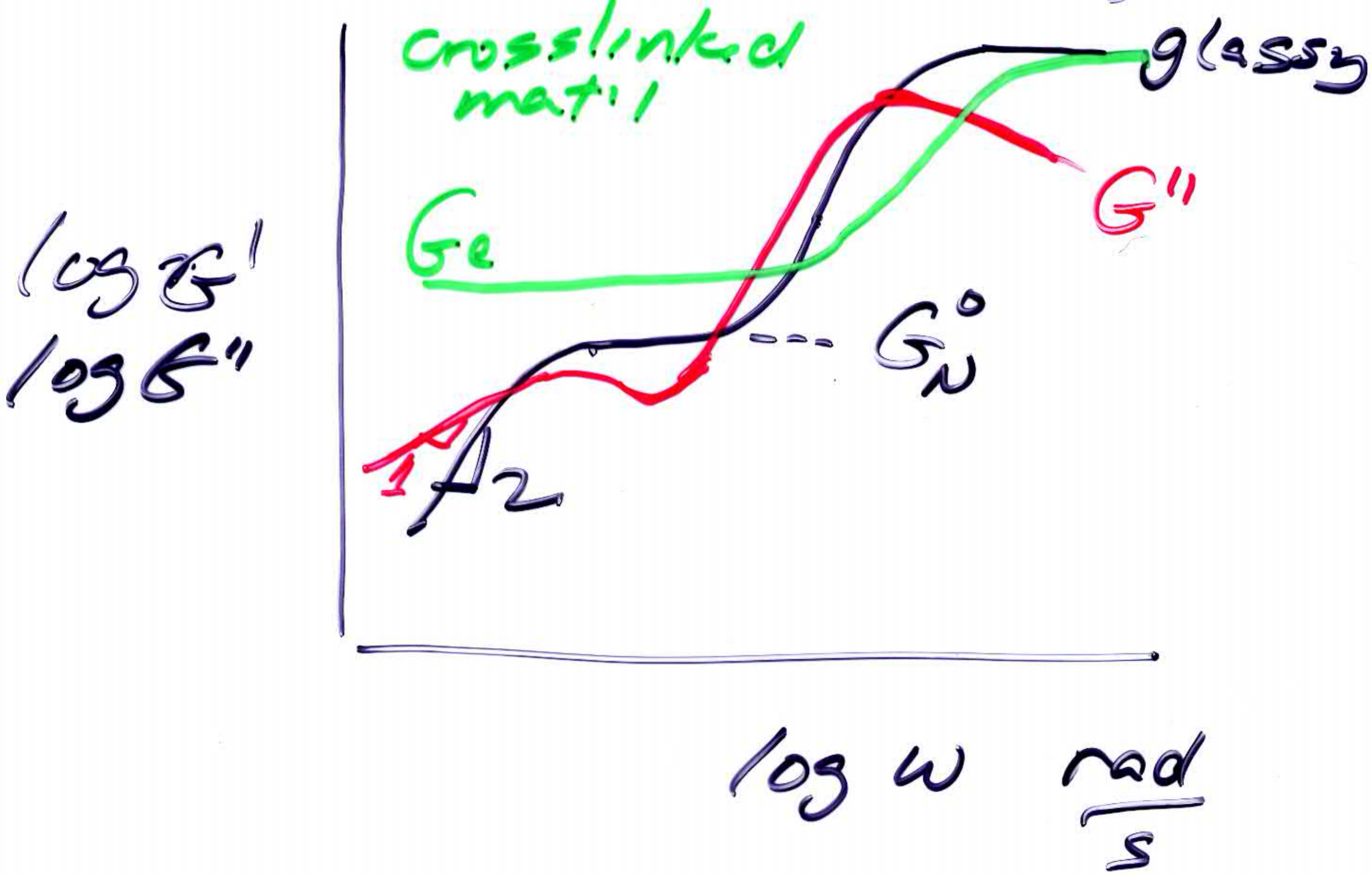
STEADY SHEAR – MIXTURES

Filled Polymers



UNSTEADY SHEAR

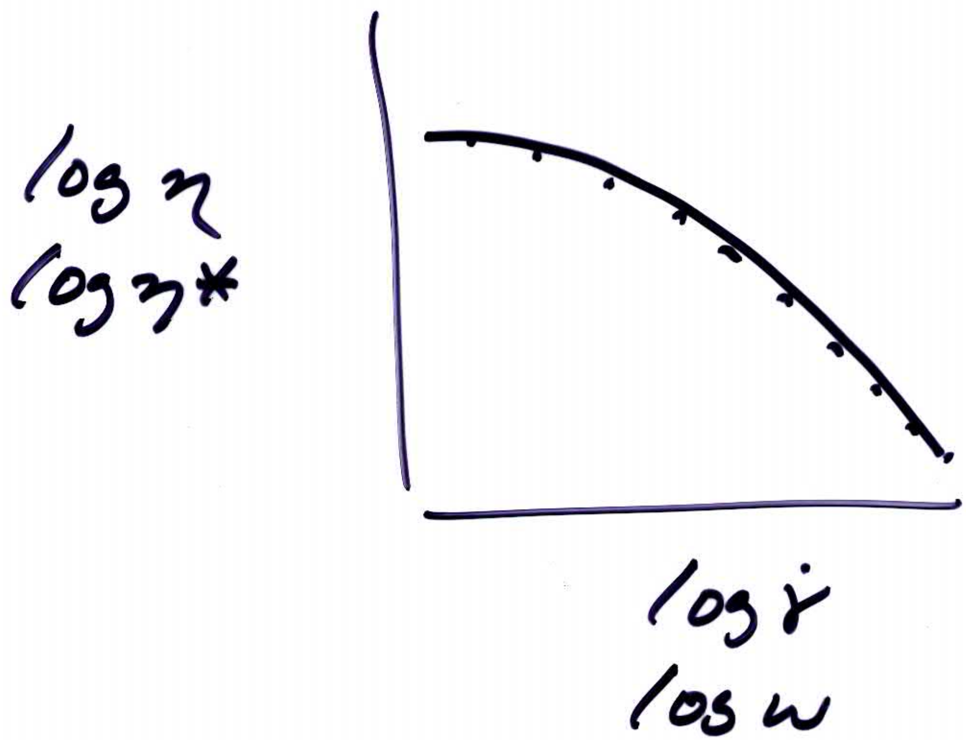
Small Amplitude Oscillatory Shear (SAOS)



Cox-Merz Rule

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

↑ rad/s

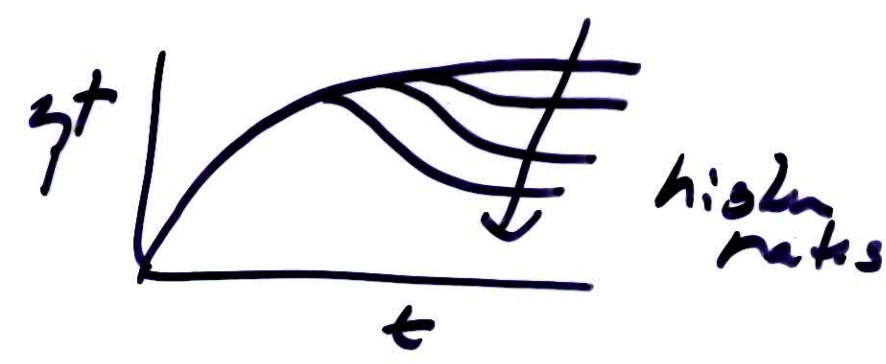


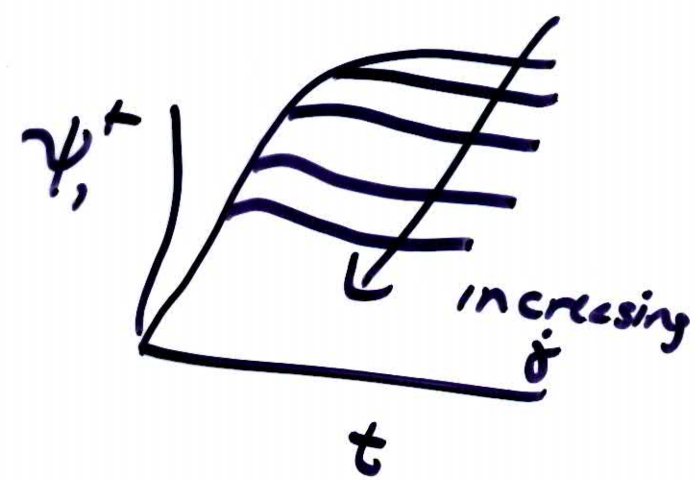
Same!

UNSTEADY SHEAR (continued)

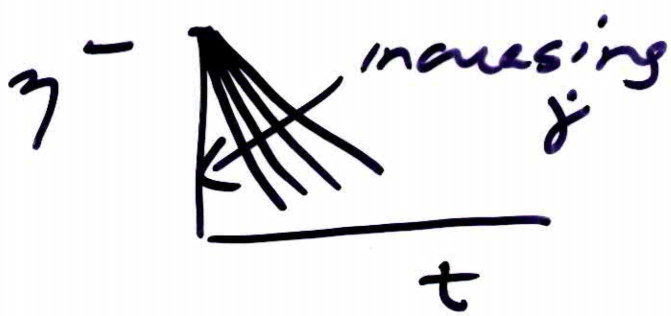
LARGE STRAINS

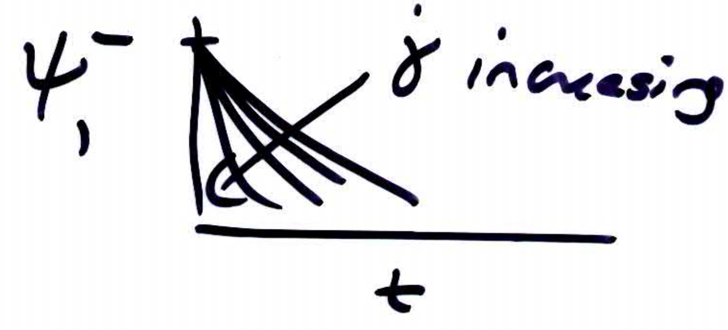
start-up



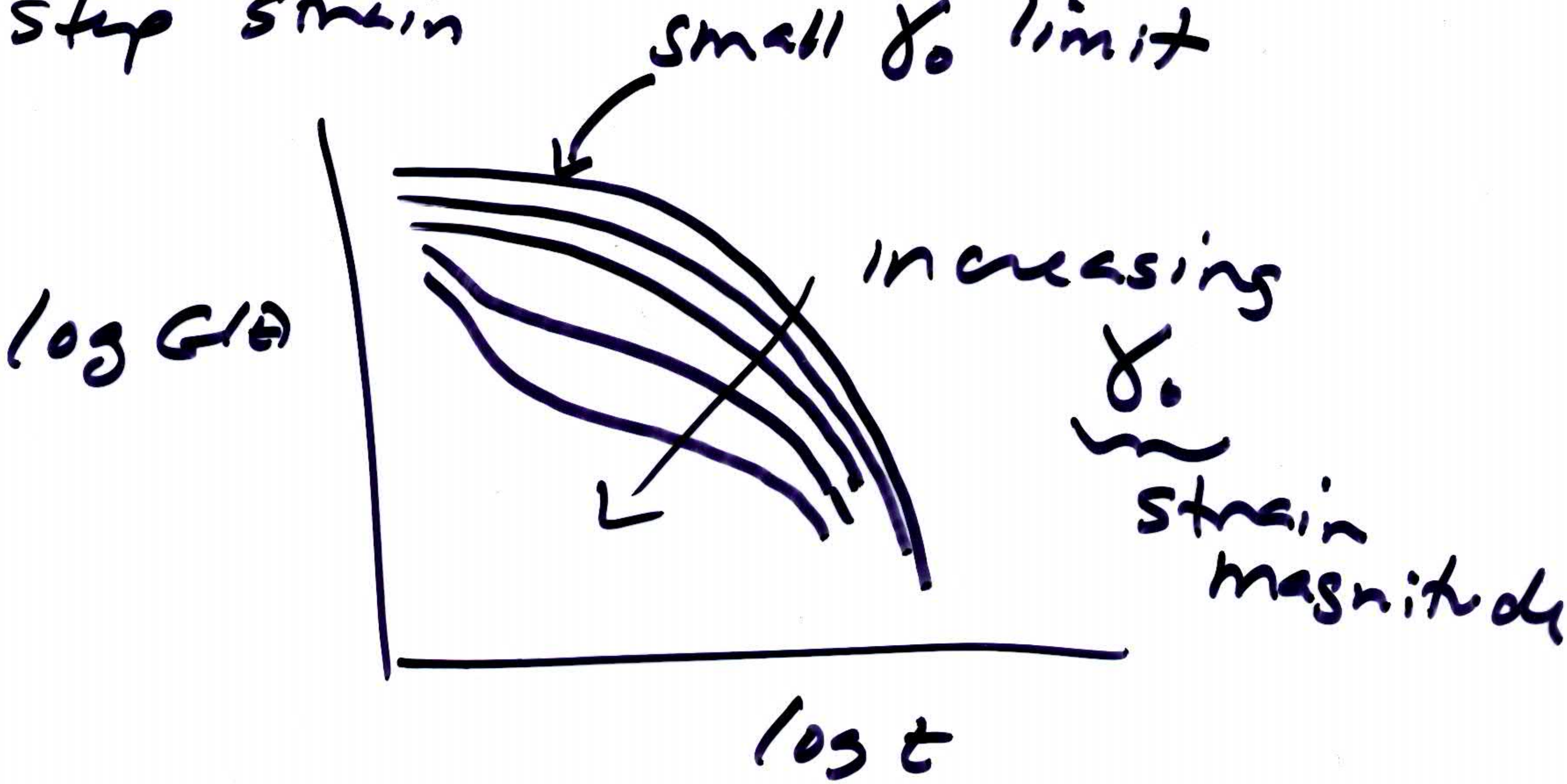


cessation

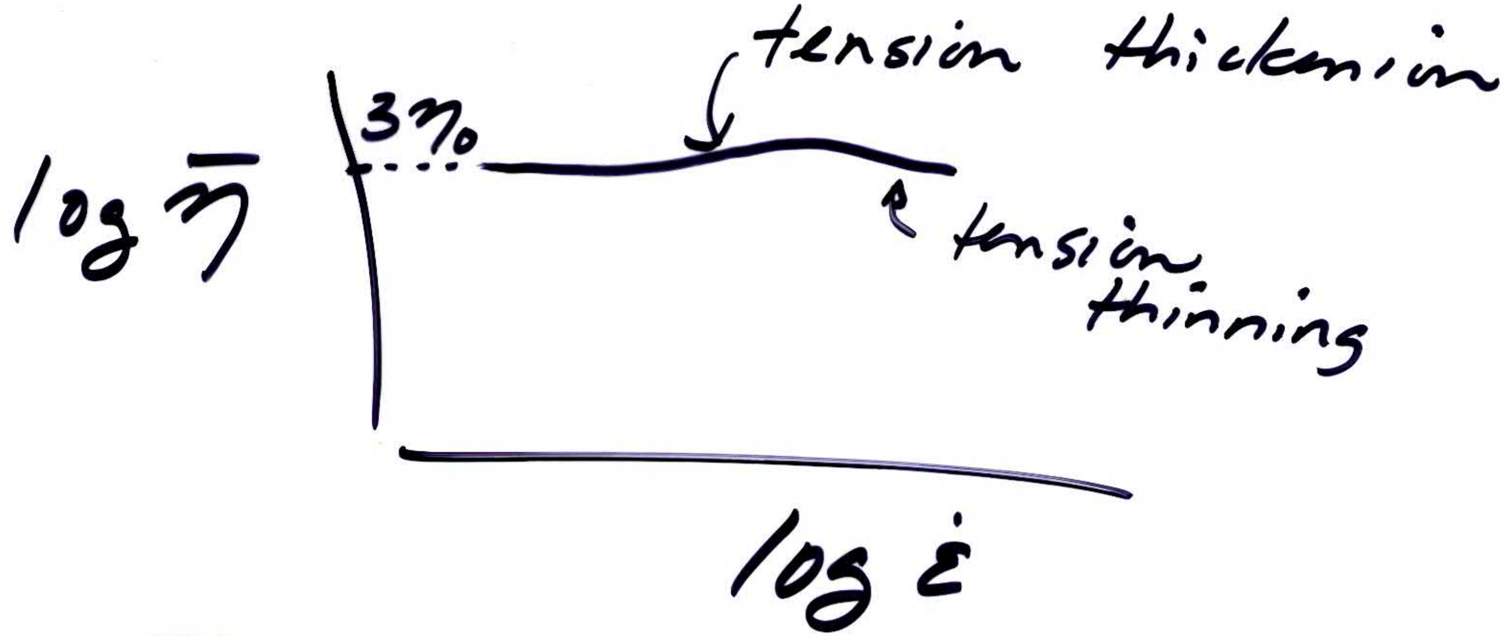




step strain

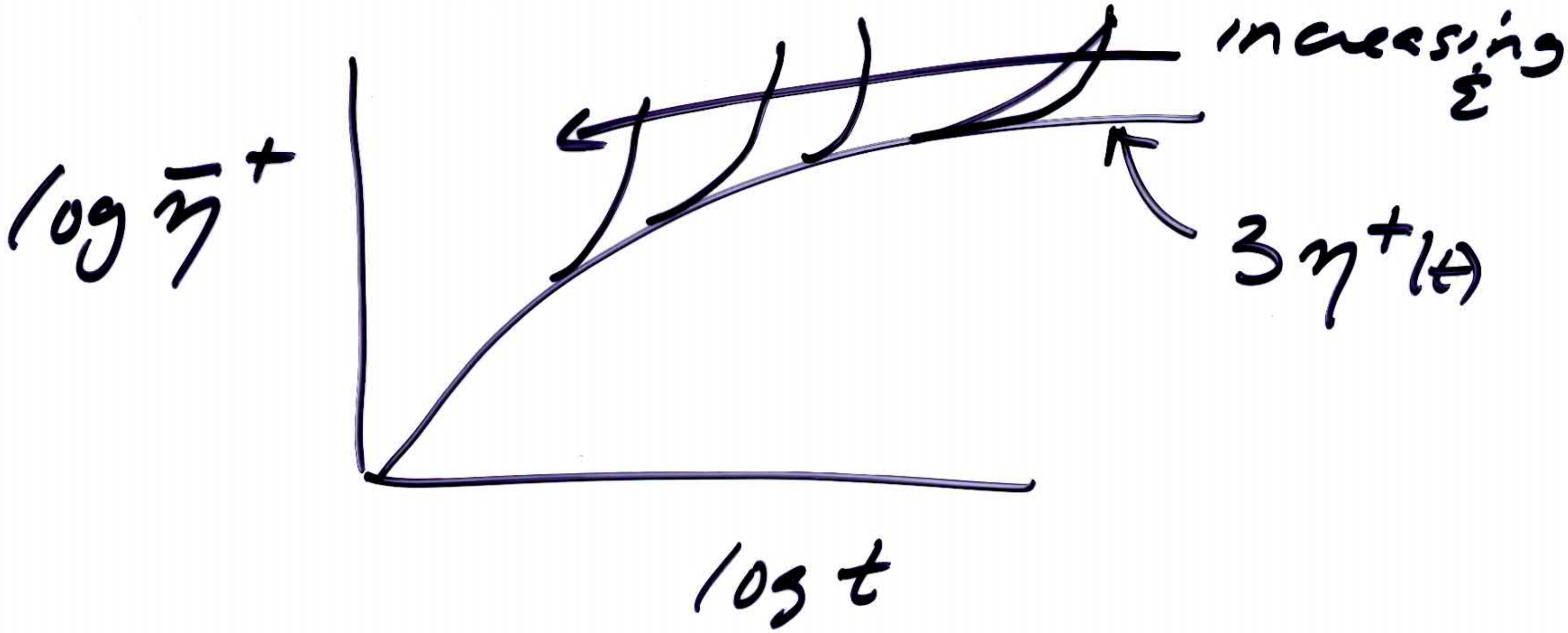

small γ_0 limit
log G(t)
increasing γ_0
strain magnitude
log t

STEADY ELONGATION



Trouton Ratio $\dfrac{\bar{\eta}}{\eta} \cong 3$ (at low rates)

UNSTEADY ELONGATION



NOTE:
At low rates, low strains shear + elongation are easily interrelated

$$\bar{\eta} = 3\eta$$

$$\bar{\eta}^+(t) = 3\eta^+(t)$$

LARGE STRAIN ELONGATION:

⇒ damping function

⇒ same as shear at low strain

⇒ different at large strain.