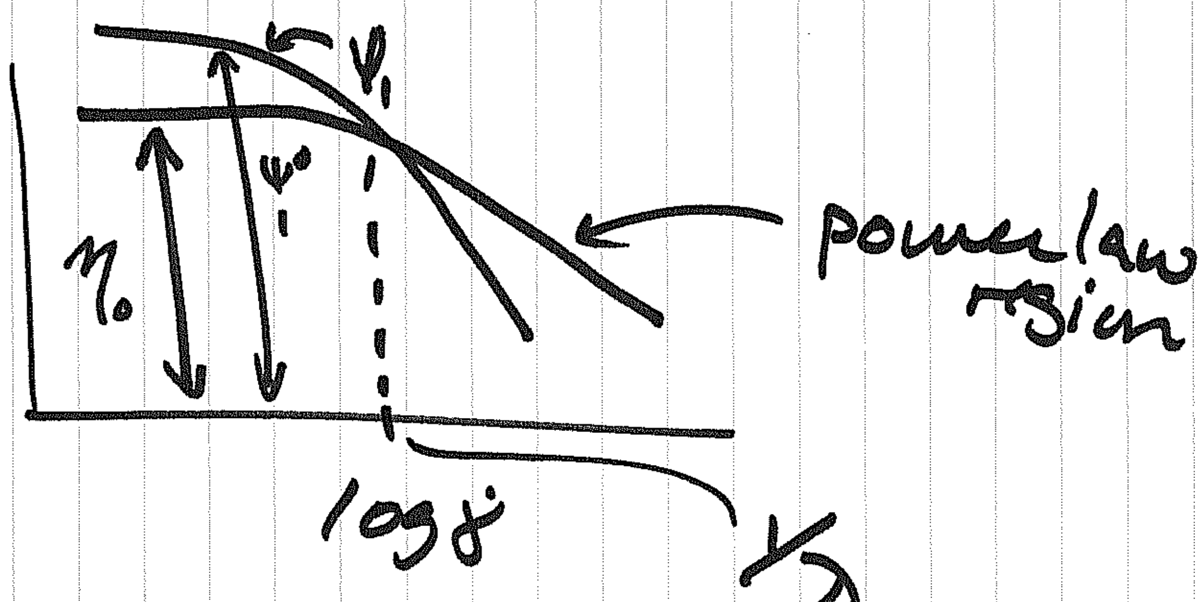
MATERIAL BEHAVIOR

I STEADY SHEAR

1 Linear Polymers

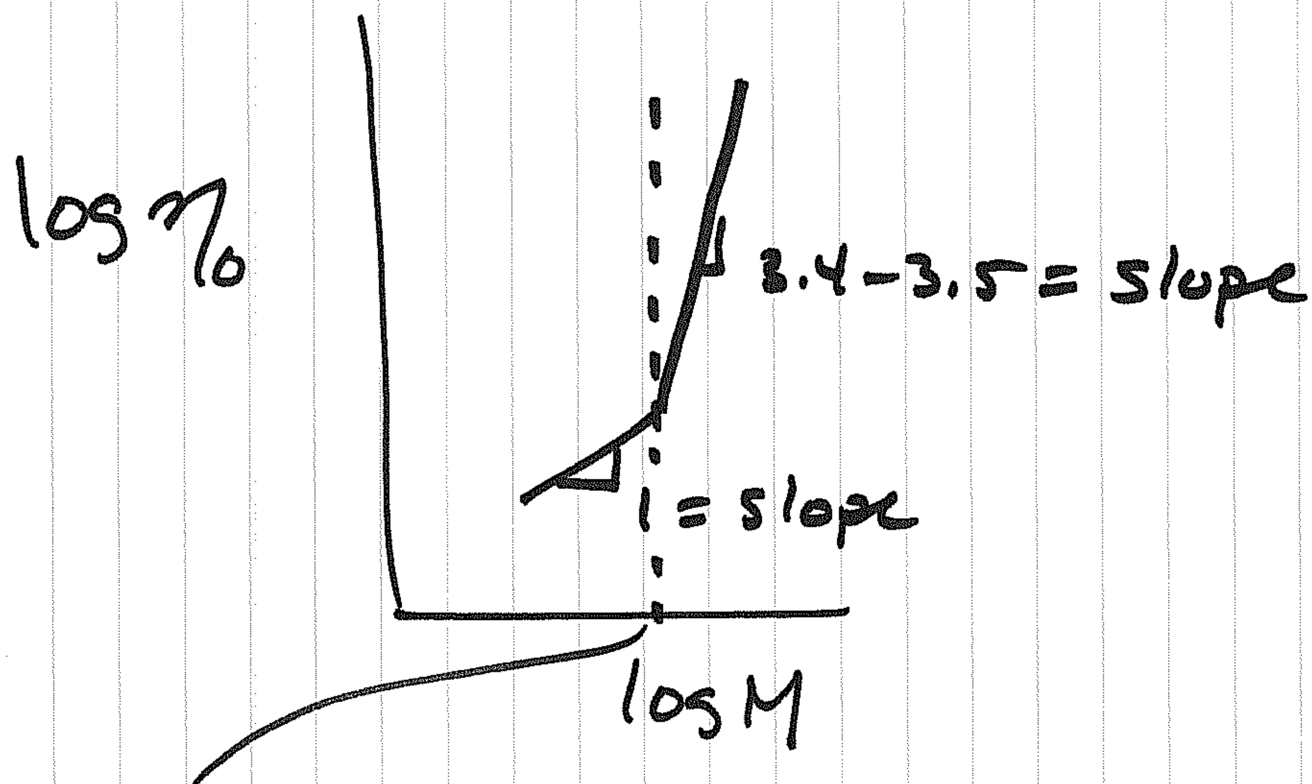


η_0 = zero shear viscosity

λ = longest relaxation time

$\eta(\dot{\gamma})$ "thins" by several decades (orders of magnitude)

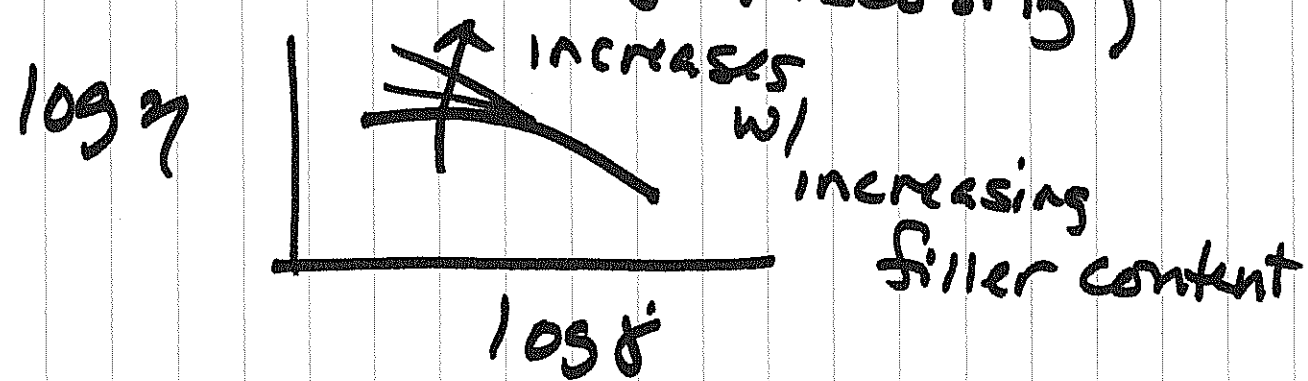
☆ → $N_2 \approx -N_1/10$



M_c = critical molecular weight for entanglement
(you can look these up)

2. Chemical / Molecular } structure

- branching strongly affects η_0
- adding filler increases η at low $\dot{\gamma}$ (filler effect) (does not effect high $\dot{\gamma}$ viscosity)

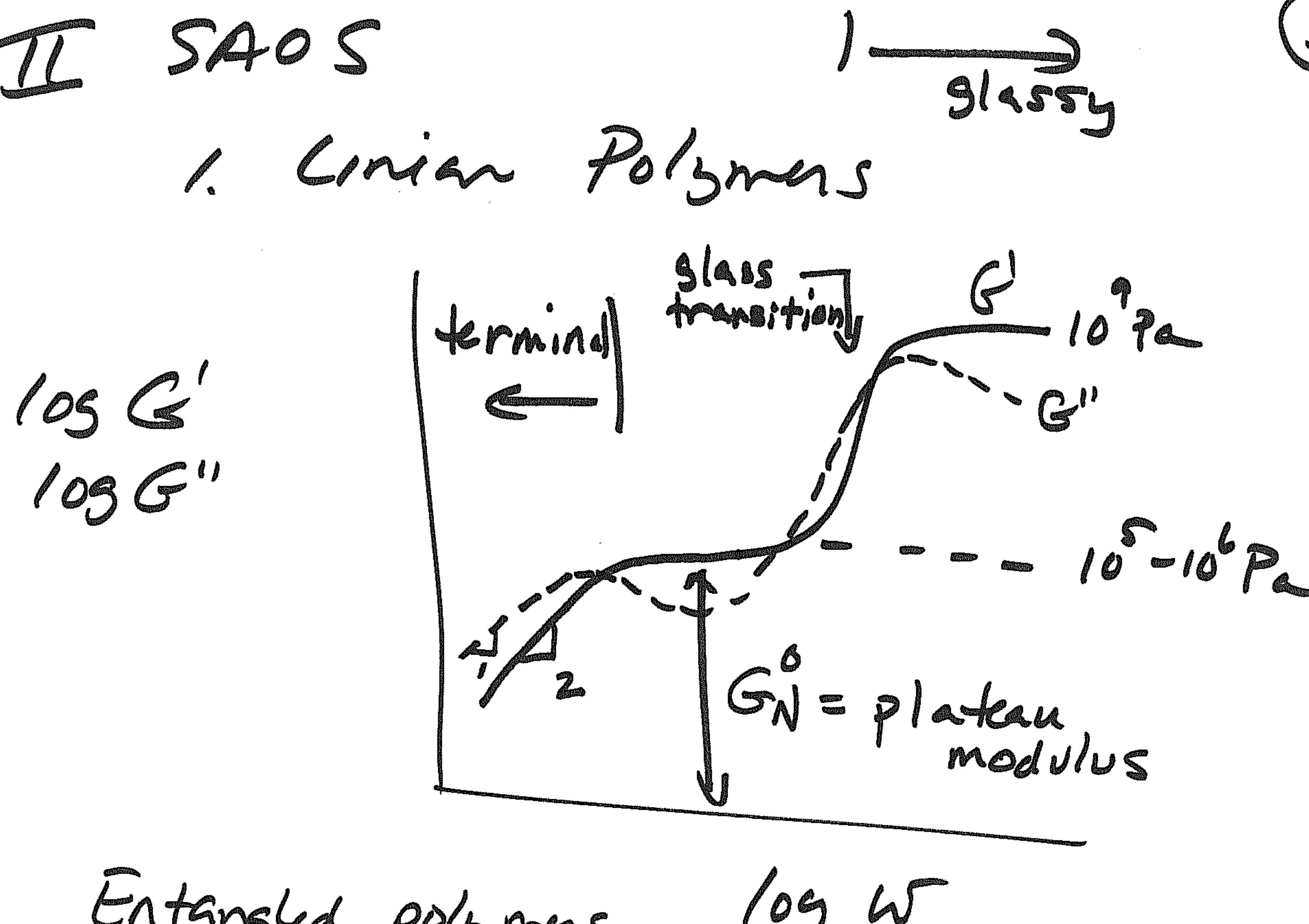


3. Temp / Pressure

- Temp has enormous effect (as important as MW)
- Pressure is not important except in very powerful industrial equipt.

II SAOS

1. Linear Polymers



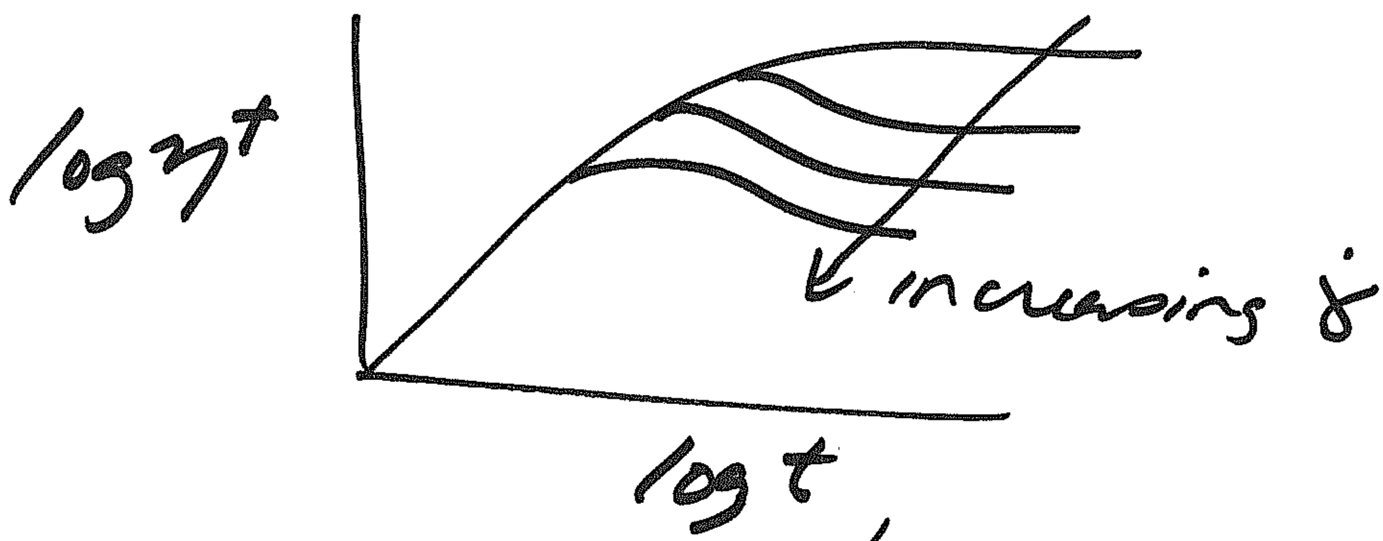
Entangled polymers show a plateau modulus that broadens w/ increasing M

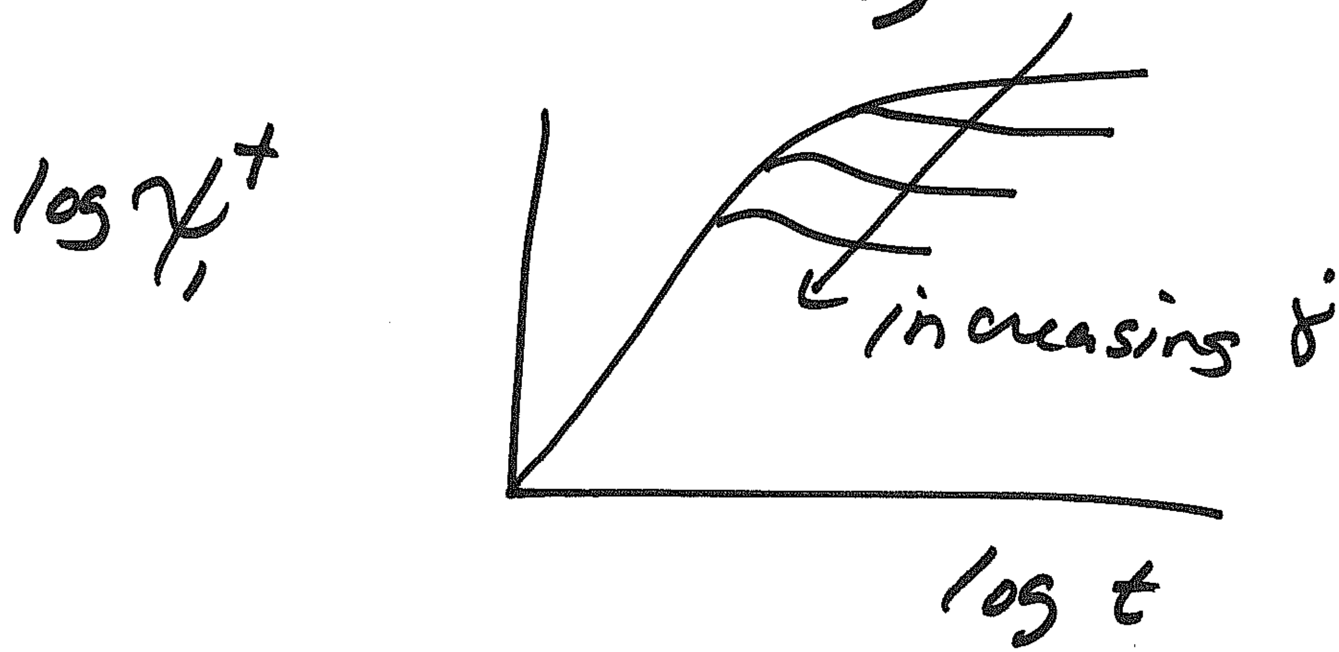
Cox-Merz Rule

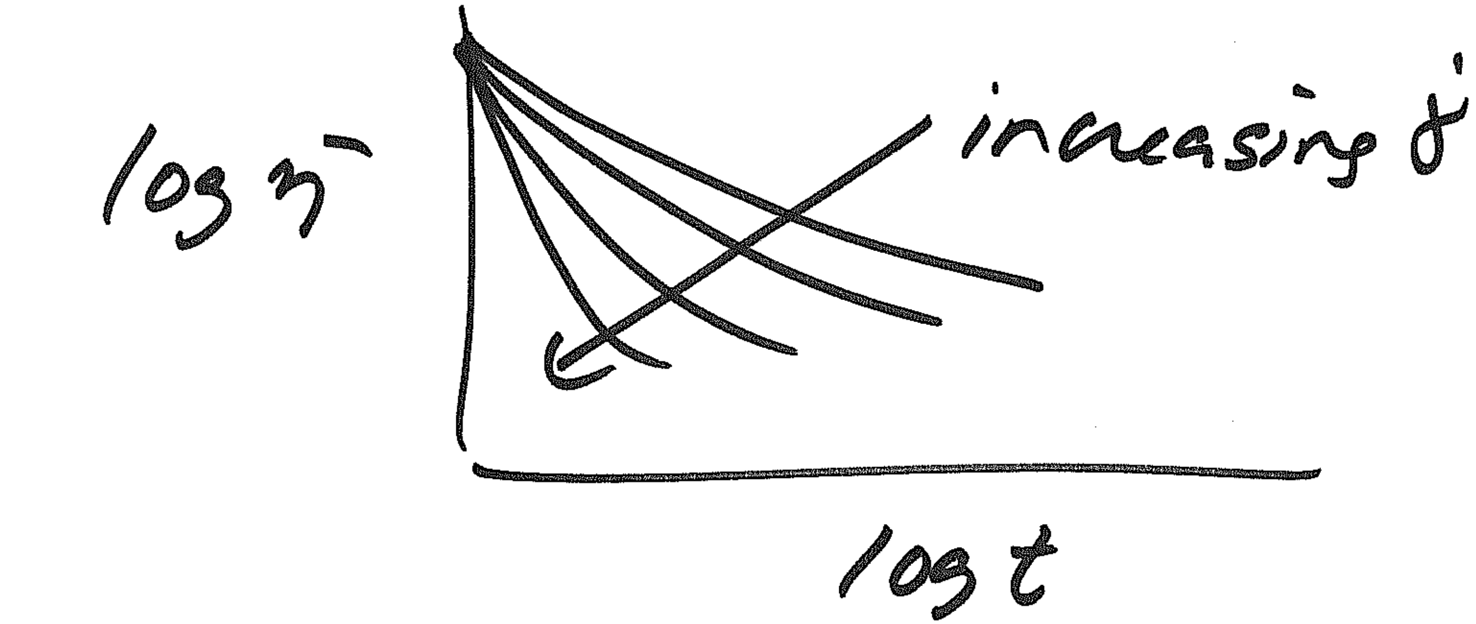
$$\eta^*(\omega) = \eta(\dot{\gamma})\Big|_{\dot{\gamma}=\omega}$$

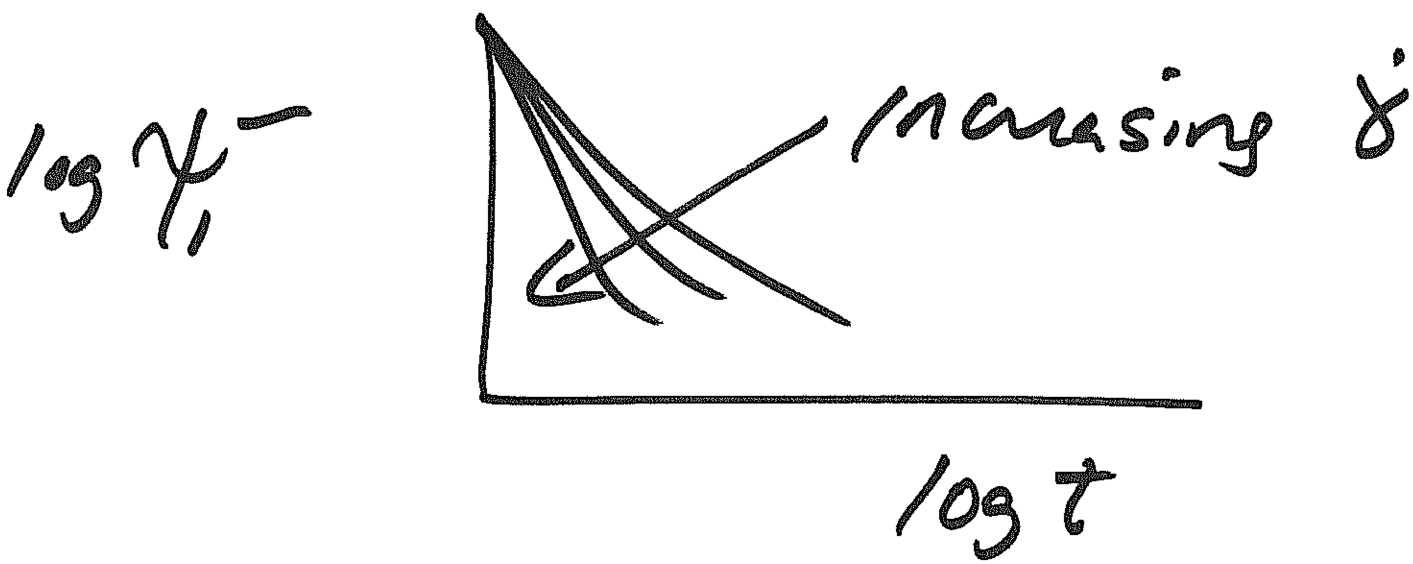
(must be validated for every material)

III SHEAR STARTUP / CESSATION

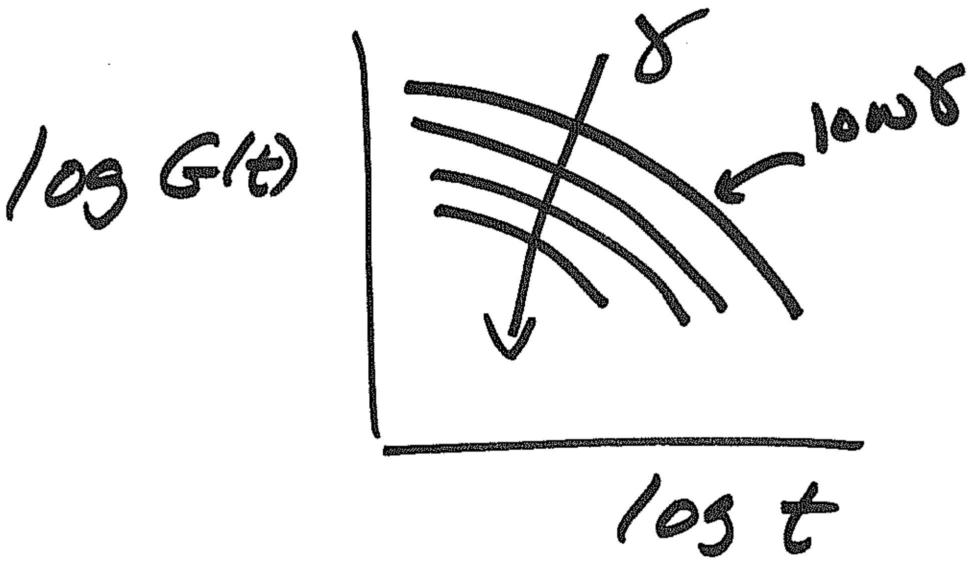


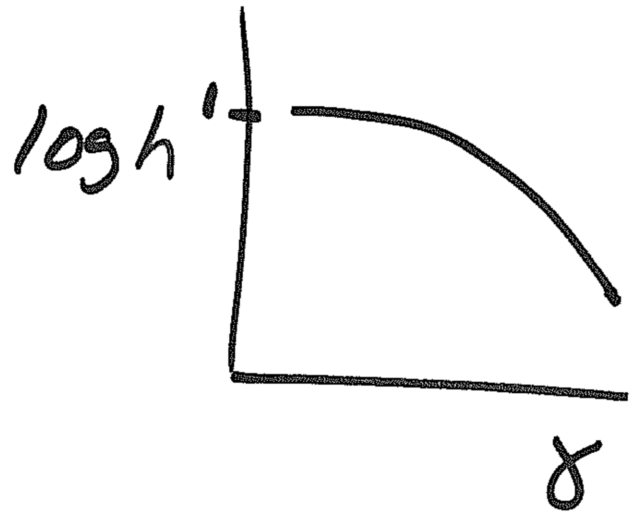



log η^-
increasing $\dot{\gamma}$
log t


log Ψ_1^-
increasing $\dot{\gamma}$
log t

IV STEP STRAIN (SHEAR)





vertical shift by log h yields
a master curve

V Elongation