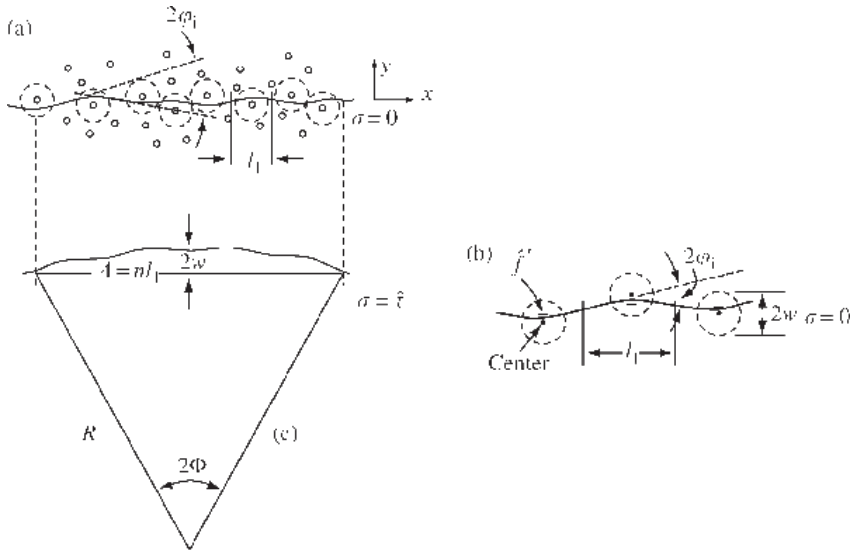
TAM 554 Homework #2- MTS Model (thermal activation)
Due September 15, 2021 Name_____

In Prof. Argon's book on pp. 151-152 A.S.Argon, Strengthening Mechanisms in Crystal Plasticity, Oxford, 2008 https://i-share-uiu.primo.exlibrisgroup.com/discovery/fulldisplay?docid=alma9976308711220589 9&context=L&vid=01CARLI_UIU:CARLI_UIU&search_scope=MyInstitution&tab=LibraryCatalog&lang=en the thermal assisted advance of a dislocation in a field of solute atoms in an fcc metal is considered. We are only considering the second term in the MTS model.



The final equation is given in the following form.

$$\sigma(T,\dot{\gamma}) = \tilde{\tau}\left(1-\left(\frac{T}{T_0}\right)^{\frac{2}{3}}\right)$$

and

$$T_0 = \frac{\Delta G_0^*}{k.\ln\left(\frac{\dot{\gamma}_0}{\dot{\gamma}}\right)} \quad where\ \dot{\gamma}_0 = b\,\rho_m\,\bar{y}\,v_G$$

$\hat{\tau} = Peak\ resistance\ (MPa) = 10MPa$

$w = Characteristic\ Distance = 2b$

$b = Burgers\ Vector = 3.5A$

$\mu = Shear\ Modulus = 80GPa$

$\rho_m = Dislocation\ Density = 10^8 cm^{-2}$

$\bar{y} = \frac{4}{3}w$

$v_G = 5.\ 10^{11}\ \ sec^{-1}$

$k = Boltzman\ Constant\ ; \frac{k}{b^3} = 0.59\ \frac{MPa}{K}$

$where\ \Delta G_0^*\ is\ given\ as\ Eqn.5.49a,b\ (Argon)$

Create plots of flow stress as a function of temperature at different shear strain rates of 10^{-1}, 10^{-3}, and 10^{-5}1/sec?

Create plots of flow stress as a function of shear strain rate at different temperatures in the range 0 to 600K.

ps. please do not derive the above equations.