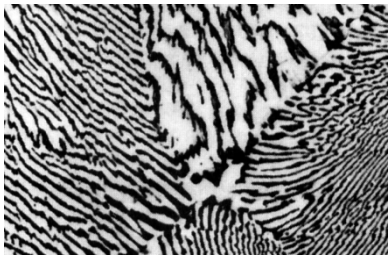
Quiz 2 November 8, 2010 Properties of Materials

The following micrograph shows the structure of a metal alloy.



a) Sketch a simple phase diagram that could explain this grain structure.

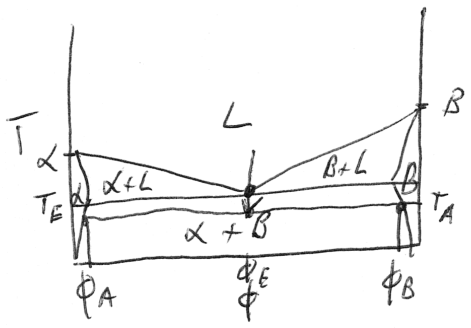
b) Pick a temperature in the phase diagram and give the composition of the two phases as well as the relative amount of the two phases present in the micrograph.

c) What is coke and why is it used in the production of steel rather than using coal?

d) For a liquid that phase separates into two liquid phases on cooling write an expression for the Gibbs free energy of mixing as a function of temperature and composition.

e) How can a cloud point curve (UCST phase diagram) be obtained from the expression in part d?

a)



at T_A & ϕ_E the lamellar structure can form.

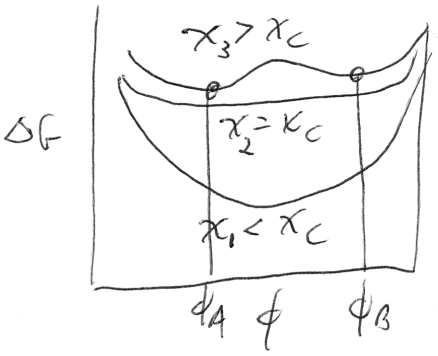
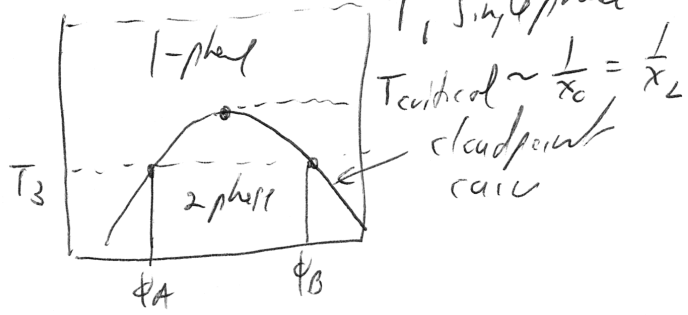
b) The lamellar structure will be of composition ϕ_A & ϕ_B in the phase diagram. the amount of ϕ_A is $\frac{\phi_B - \phi_E}{\phi_B - \phi_A}$ and the amount of ϕ_B is $\frac{\phi_E - \phi_A}{\phi_B - \phi_A}$.

c) coke is coal heated with no O_2 to remove moisture & impurities. It is used in steel production to reduce Fe_2O_3 + because it is in pure form of Carbon so fewer impurities.

d) $$\frac{\Delta G}{NKT} = \phi \ln \phi + (1-\phi)\ln(1-\phi) + \phi(1-\phi)\chi$$

$$\chi = \frac{z\,\Delta\varepsilon}{KT} \sim \frac{1}{T}$$

e) vary χ in eqn (d)



for $\chi_3 \sim \frac{1}{T_3}$