

Homework 5 Properties of Materials

- 1) Describe the stages of steel production beginning with iron ore and coal.
- 2) Mixing of two liquids or gases can be modeled using a lattice model, Boltzmann's expression for entropy and a term expressing the average enthalpy of mixing.
 - a) Give an expression for the free energy change on mixing and indicate the entropic and enthalpic components of this expression.
 - b) Sketch this free energy change as a function of composition for several values of the enthalpic interaction parameter above, below and at the critical temperature.
 - c) How can the expression for the free energy be used to calculate the phase diagram?
 - d) Sketch the phase diagram (T versus composition) for a binary system displaying an upper critical solution temperature.
 - e) Show how the composition and amounts of the two phases in the phase separated UCST system can be determined using the lever rule.
- 3)
 - a) For a binary isomorphous system sketch the phase diagram showing the liquidus and solidus lines and the composition of the phases. (Define this type of system.)
 - b) For a binary eutectic system sketch the phase diagram showing the liquidus, solidus, solvus lines and the eutectic isotherm and eutectic point.
 - c) Explain what an intermediate solid solution is in the Cu-Zn phase diagram.
 - d) Explain what an intermetallic compound is in the Mg-Pb system.
 - e) Define Eutectoid, Eutectic and Peritectic and show examples of these reactions in the Cu-Zn system and in the Fe-C system for steel.