FMS 2017 5(9,(: **PROBLEMS** IRU(;$0 ,,, 'HIHFW

Please staple this sheet to the front of your assignment before you turn it in. Make sure that you have used grid paper, circled all problem numbers, and boxed all answers on your papers. You must show all supporting work in order to receive full credit for a problem.

(1) Gold (Au) has a density of 19.32 g/cm^3 and an atomic weight of 196.9 g/mol. The energy required for vacancy formation in gold is 0.98 eV/atom. Calculate the vacancy density (number of vacancies per cubic meter) in gold at 800 °C.

(2) Refer to the table that is shown in problem 5.5 on page 159 in your textbook. The table shows atomic radius, crystal structure, electronegativity, and most common valence for several elements. Note that the non-metals in the table only have atomic radius listed. Which of the elements in the table would you expect to form the following with nickel (Ni): (a) a substitutional solid solution having complete solubility; (b) a substitutional solid solution of incomplete solubility; and (c) an interstitial solid solution.

(3) Calculate the composition, in weight percent, of an alloy that consists of 92.0 kg of iron (Fe), 0.2 kg of carbon (C), and 1.8 kg of chromium (Cr). Round your weight percentages to the nearest 0.1 wt%

(4) What is the composition, in atom percent, of an alloy that contains 22.3 lb_m of silver (Ag), 41.8 lb_m of gold (Au), and 5.4 lb_m of copper (Cu). Round your atom percentages to the nearest 0.1 at%.

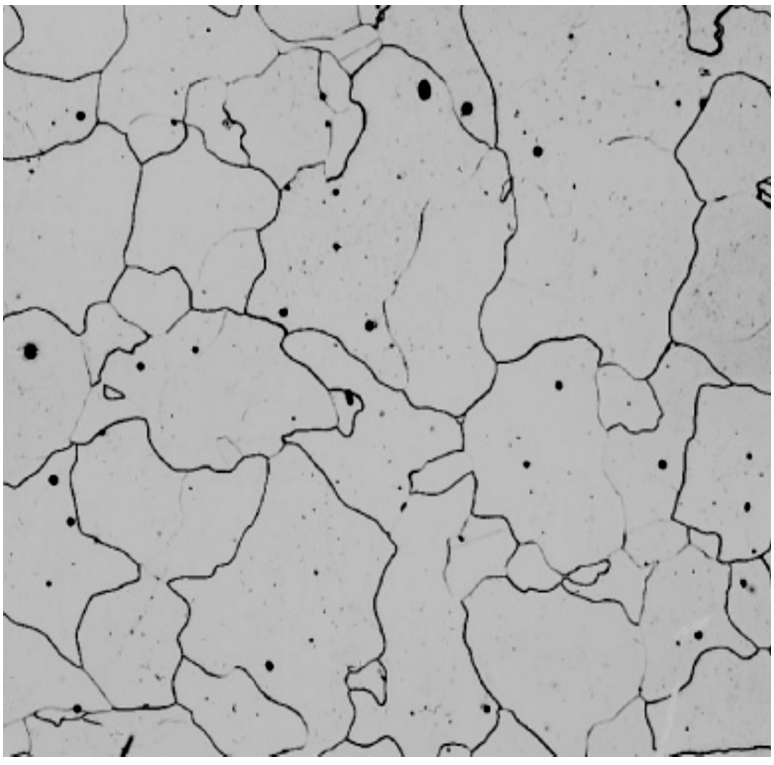
(5) Niobium (Nb) forms a substitutional solid solution with vanadium (V). Compute the number of niobium atoms per cubic centimeter for a niobium-vanadium alloy that contains 28 wt% niobium and 72 wt% vanadium. The density of pure niobium is 8.57 g/cm^3, and the density of pure vanadium is 6.10 g/cm^3.

(6) Gold (Au) forms a substitutional solid solution with silver (Ag). Compute the weight percentages of gold and silver you would have in a gold-silver alloy that contained 5.5x10^{21} gold atoms per cubic centimeter. The density of pure gold is 19.32 g/cm^3, and the density of pure silver is 10.49 g/cm^3.

(7) For each of the following stacking sequences found in FCC metals, identify the type of planar defect that is evident and draw a vertical dashed line through the position(s) of the planar defect(s).

(a) A B C A B C A B C A B C B A C B A C B A C B A (b) A B C A B C B C A B C A B C A B C B C A B C A B C

(8) Using the photomicrograph shown to the right, employ the intercept technique to determine the average grain size for the steel specimen shown. You will need to draw at least seven straight-line segments. The magnification factor of this image is 600x (you will need to know that). Estimate the ASTM grain size number for this material.



(9) For an FCC single crystal, would you expect the surface energy for a (100) plane would be greater of less than that for a (111) plane? Explain your answer (and with some quantitative evidence if you can).

(10) For an FCC single crystal, would you expect the surface energy for a (100) plane to be greater or less than that for a (111) plane?