HW #6 Chapters 6 and 7

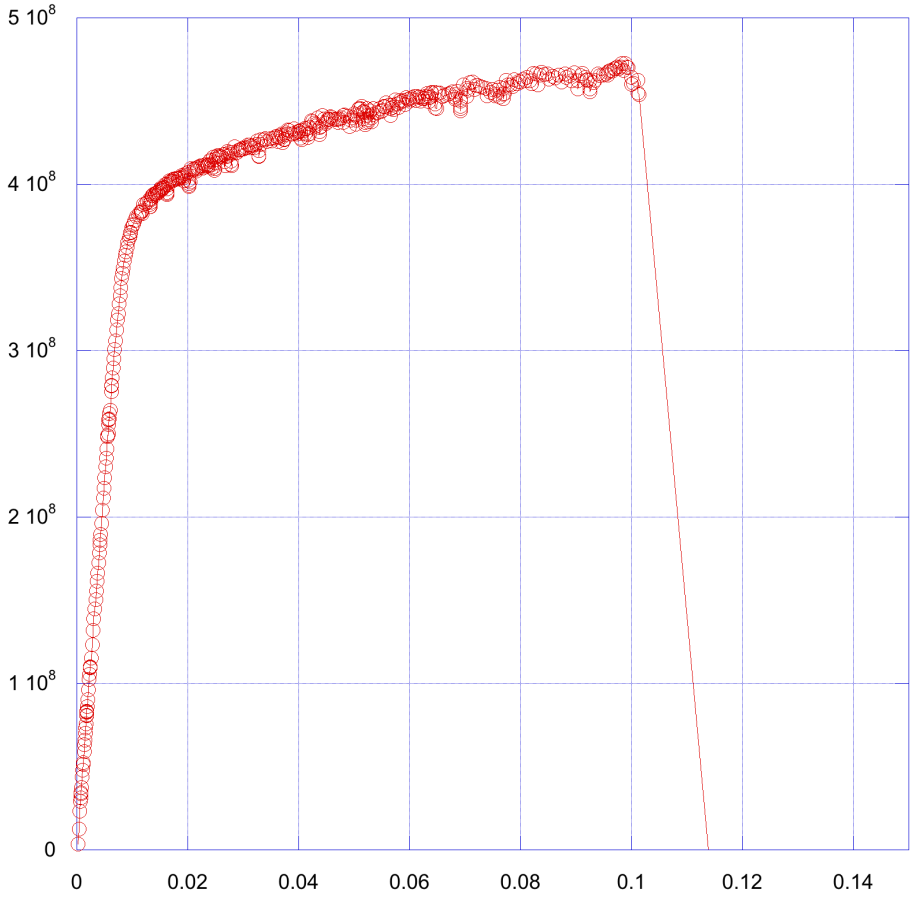
1) A cylindrical nickel wire 2 mm in diameter and 3 m long is subjected to a load of 300 N. What is the final length if a load of 300 N is applied? What load would be required to bring the sample to its yield stress? What would be the length of the sample loaded to the yield stress?

2) The stress-strain plot enclosed (with the stress on the y-axis in Pa, and strain on x-axis) was determined using the small tensile testing machine demonstrated in class on an aluminum sample. The second graph shows the same data, replotted with a different x-axis scale to focus on the small strain region. From the data, estimate the following parameters: a) the Young's modulus, b) the yield strength using plastic strain offset of 0.2%, c) the yield strength using the total strain of 0.5%, c) the elongation at break, d) the tensile strength, and e) the toughness, as determined by the total energy of failure.

3) A 70 Cu – 30 Zn Brass alloy is examined in a microscope and found to have an average grain diameter of 10 μm. What is the expected yield strength of this sample, in MPa? The sample was then annealed at a particular temperature for 3 hours, and was found to have increased the average grain diameter to 100 μm. What would be the expected yield strength of the annealed sample? If the sample were annealed for another 6 hours at this same temperature, what would be the final grain diameter? What would be the yield strength of the sample after this second annealing step?

4) A rod-shaped sample of pure copper with an initial cross section of 10 mm x 10 mm is drawn through a rigid die with a cross section of 9 mm x 9 mm. What is the percent cold work induced by this process? What is the expected yield strength and percent elongation of the initial pure copper sample? What is the expected yield strength and percent elongation of the copper after deformation? What would be the amount of nickel that would need to be added to copper to give an alloy with the same yield strength as the deformed sample? What would be the percent elongation of this copper-nickel alloy?

Stress-Strain data for aluminum from PASCO tester



Stress-Strain data for aluminum from PASCO tester