

MSE 4241

Homework #1 (10% of grade)

Due February 3 (NEXT Tuesday) at start of class.

- 1) In about 1-2 pages, compare and contrast how one obtains images, and what is the spatial resolution (and why), for:
 - a. secondary electron SEM,
 - b. backscattered electron SEM
 - c. x-ray microanalysis in an SEM

- 2) In about 1-2 pages, compare and contrast how one obtains images/what one sees when using:
 - a. bright field TEM,
 - b. dark field TEM.
 - c. EELS

- 3) In about 1-2 pages: Describe the imaging mechanism for EITHER
 - standard 'contact mode (constant force)' atomic force microscopy,
 - OR AC mode AFM
 - OR Scanning Tunneling Microscopy.

- 4) You are using contact mode AFM with a cantilever that has a spring constant of 1 nN per nm and a tip radius of curvature of 100 nm.
 - a. What is the deflection of the cantilever when applying 10 nN of force?
 - b. What will be the indentation depth during this measurement? You may assume a reduced modulus of 100 GPa (common for Si tips on a Si sample).
 - c. What is the actual contact radius (not the radius of curvature) in this experiment (i.e. what is your best lateral resolution)?
 - d. Calculate the pressure at the tip apex ($P=F$ over actual area)