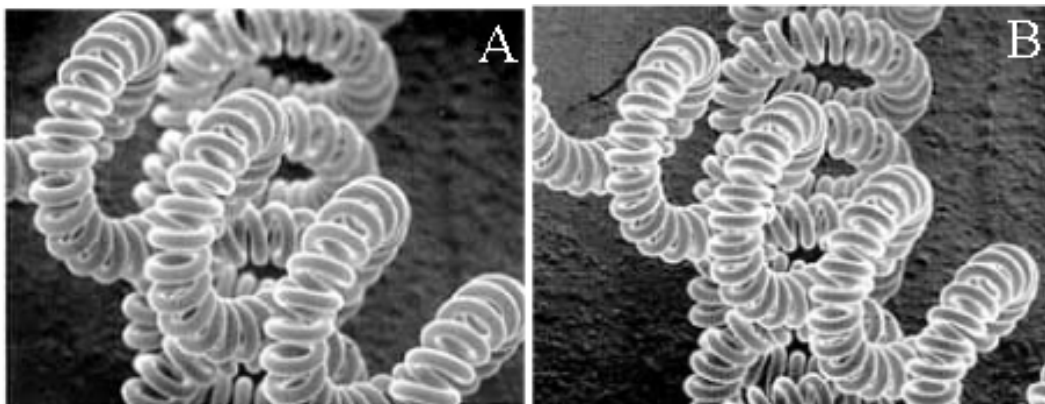


MR202

Assignment 1

Due February 15, 2010

1. An immersion lens configuration is better than the asymmetric pin-hole lens for obtaining high resolution. Why?
2. You are looking at a fracture specimen. What conditions would you use for the following to be able to simultaneously observe all the regions of the surface. a) working distance, b) aperture size. How do these parameters affect the resolution?
3. You want to separate the effects of SEI and SEII contribution to the image. How would you do this?
4. What is the typical current value required for *imaging* in the SEM? What type of electron source would you select to get the highest current?
5. You are given the Monte Carlo simulation results under two different sets of conditions. One shows a very large interaction volume while the other shows a small interaction volume. What could be the conditions used if you were told that a) the atomic number was varied, b) accelerating voltage was varied?
6. The wavelength of electrons accelerated to 20 kV is $\sim 0.08 \text{ \AA}$ implying that sub-angstrom level resolution should be possible in the SEM. Of course, this is nowhere near the resolution that is actually obtained. Why? Discuss all possible reasons for this.
7. The collection efficiency of backscattered electrons in a negatively-biased E-T detector is very low while that of secondary electrons in the positively-biased E-T detector is close to unity. Discuss in terms of how the electrons are collected in each case.
8. Fig. A and B are secondary electron images of an electric bulb coil. You are told that the conditions that the images were obtained are as follows:
 - i) 5 kV, Mag x540, Objective aperture 200 μm , Working distance 10 mm and
 - ii) 5 kV, Mag x540, Objective aperture 200 μm , Working distance 38 mm.Match the conditions with the image and justify your statement.



9. Backscatter coefficient is sensitive to difference in atomic number but is relatively insensitive to the accelerating voltage. Why?