HW Number 5

1. Assume that you are to measure a concentration profile at an interface using EDS. Would you prefer 100 kV or 250 kV as an acceleration voltage? Explain your answer.

2. Consider a 300kV electron colliding with an isolated silicon atom. What is the maximum energy that can be transferred to the silicon atom by a ballistic (knockon) process? How does this compare to the energy to produce a vacancy-interstitial pair in silicon (look this up)? Would it matter if you cooled down the sample; some people have argued that there is less damage at low temperatures.

3. A standard method of investigating the bonding of carbon-containing materials is to look at the intensity of the  antibonding feature in an EELS spectrum. Briefly explain how this technique works, and suggest a method of quantifying the amount of sp2 character in a carbon film.

4. Some bimetallic catalysts contain Pt and Pd in the form of nanoparticles which can (in principle) be either alloyed or phase separated. Compare normal HREM and ADF and HAADF as techniques for analyzing one of these catalysts. Catalysts are often deposited on a different support material to increase surface area. What effect will the support on which the nanoparticles sit have in the images, both in terms of its thickness and structure as well as density? What is the role of the inner collection angle on the ADF/HAADF images?