061201 Quiz 9 XRD

1) Give the two examples of static and dynamic elastic scattering discussed in class and describe the correlation function associated with each.

2) What two kinds of spectroscopy (inelastic scattering) were discussed that use x-rays as the incident radiation. Give the difference between these two techniques.

3) Why is a large magnetic field needed for NMR spectroscopy? Explain the terms deshielding and shielding of nuclei. What is a FID.

4) What is the difference between bright field and dark field imaging in a TEM?

5) Give 3 differences between an electron beam and an x-ray beam that effect diffraction.

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1) The examples given in class were x-ray diffraction and dynamic light scattering. The correlation function for x-ray diffraction is the pairwise correlation function of electron density in space and for dynamic light scattering it is the time correlation function for fluctuations in intensity.

2) XAS orXAFS and ESCA or XPS. X-ray absorption spectroscopy involves a plot of absorption versus wavelength or frequency showing various absorption edges and the lambda cubed decay in absorption with wavelength. XAFS can be used to determine ionization states of metals. X-ray photoelectron spectroscopy involves measurement of the number of photoelectrons ejected from the surface by incident x-rays at various energies. This is used to characterize the chemical composition of the surface.

3) The large magnetic field "holds" the nuclear spin magnetic moments so that they can absorb radio frequency radiation. Deshielding indicates the partial removal of electrons from around a nucleus by neighboring chemical groups such as a halide or aromatic group. Shielding indicates the addition of electrons around a nucleus by neighboring chemical groups such as a metal. FID is the free induction decay which is the observed signal in a pulsed NMR experiment.

4) Bright field image is the normal TEM image made from the full incident beam. Dark field image is an image constructed from one diffraction spot.

5) Electrons have much lower wavelength, electrons are absorbed at a much higher rate and they can generate secondary electrons and can charge a sample so as to build up a repulsion between the incident radiation and the sample. The electron beam is focused and much smaller than the x-ray beam so that it can be aimed at a single small grain. There are other differences.