Samples and Sample Environments—What You Need

To have a successful neutron scattering experiment, you must know a few things about your sample beforehand:

(1) Crystal structure of the sample (for example, tetragonal, cubic, hexagonal...)

(2) Lattice parameters which define that crystal structure (for example, if the crystal structure is cubic then the lattice parameter is same along all axes)

(3) Information about the magnetic moment of the magnetic constituent(s) of the chemical compound (for example, if you want to measure Tb2Ti2O7 then you need to know the magnetic moment of the Tb-ions as this is the only magnetic ion in this compound. THE LARGER THE MAGNETIC MOMENT THE EASIER THE OBSERVATION)

(4) In the case of elastic scattering measurements, the integrated intensity is proportional to the square of the magnetic moment. On the other hand, if the measurement is inelastic then integrated intensity varies linearly with the moment. Therefore, inelastic measurements require bigger samples for smaller magnetic moment constituents

(5) Collect as much information as possible via different measurements (for example, SQUID Magnetometer, XRAY…) before coming for neutron scattering measurements

(6) You need to know the basic crystal structure and the scattering plane

(7) Try to avoid elements that are strongly absorbing (^{6}Li, ^{10}B, ^{113}Cd. for a complete listing go to; http://www.ncnr.nist.gov/resources/n-lengths)

Sample "Design" for Triple Axis Spectrometer

• Single crystals yield the most information (increase the intensity by increasing the amount of the sample)

• If you have a powder sample, use a cylindrical container

• Most experiments on triple-axis spectrometers involve coherent scattering therefore avoid strong incoherent scatterers; sample should be deuterated if it contains H at all.

Sample Environment

Using the right sample environment is a very important aspect of neutron scattering experiments. Details about the sample environment can be found at http://www.ncnr.nist.gov/equipment/ancequip.html

• Always choose the simplest sample environment to get the measurement done (for example, if your sample exhibits a zero field magnetic phase transition at 5 K and you want to solve the magnetic structure then ask for "ORANGE CRYOSTAT" *not* the ^{3}He system or 11.5 T magnet with dilution insert)

• Based on the purpose of the measurements, the sample environment can be chosen from a wide range of available options (CCR with base temperature of 1.7 K, CCR (5 K), High temperature CCR (600 K), 50 mm and 70 mm orange cryostats, ^{3}He insert, 7T magnet with base temperature of 4 K (option of ^{3}He insert), 15 T magnet with stick (1.5 K – 300 K) or dilution insert option (BT-7 only), 11.5 T magnet with dilution insert, hydrostatic pressure cells and many more.

• Each sample environment has its own sample space limitation. Therefore, once you are ready to mount your sample, chose the appropriate size sample cans.