Contribution ID : **108** Type : **Poster**

The cryogenic and vacuum system for a neutron low-energy bandpass filter spectrometer

Neutron spectroscopy is a powerful technique that involves analysing the inelastically scattered neutron signal from a sample in the thermal and cold neutron energy regime in order to obtain information regarding low energy excitations, vibrational density of states, and phonon distribution, of the material under investigation. Most neutron spectroscopy is performed at large facilities which are either neutron research reactors or neutron spallation sources. Spectrometers generally are medium to large instruments that take can take up considerable space and that involve heavy radiation shielding. In the case of the so-called Beryllium Filter Spectrometer, recently built, and now in operation over the last two years, at the Australian Centre for Neutron Scattering, in Sydney, five tonnes of high density radiation shielding surrounds the ~ 1m^3 stainless steel vacuum chamber that houses around 300 kg of filter block material. The entrance and exit windows of the spectrometer consist of an arc of 4mm thick Al-alloy material. The filter blocks are arranged within the vacuum chamber in arcs directed along the neutron scattering arc and consist of banks of Bismuth, Graphite and Beryllium. For the spectrometer to operate properly, that is to filter out neutrons greater than 1.8 meV, all filter blocks are cooled to below 80K through cryogenic refrigeration that is based on a closed-loop helium expansion cycle. Two vacuum cryogenic refrigeration systems are connected to the vacuum chamber. Each identical system consists of a compressor package, which compresses refrigerant and removes heat from the system as well as the cold head itself, which takes refrigerant through one or more additional expansion cycles to cool it down to cryogenic temperatures (< 20K). The filter blocks are attached to this cooling system through oxygen free copper braids and connecting plates and frames. When in operation, under a vacuum of ~2x10-8 mbar, the filter blocks reach a temperature of 80K and better within 48 hours. The filter spectrometer has been used in this state for months without degradation of vacuum or temperature of filter blocks.

Finite element analysis is presented for the structural integrity of the vacuum chamber as well as the heat transfer expected for the cryorefrigeration system. Deflection, pump down and cool down results are given for comparison. All in all the design performs very well allowing for seamless continuous operation to be achieved.

Primary author(s) : Dr STAMPFL, Anton (Australian Nuclear Science and Technology Organisation); CHELLAPPAH, Aravinthan (ANSTO); Mr KAFES, Anthony (ANSTO); Mr PERRY, Merv (ANSTO); Mr BARTLETT, Dan (ANSTO); Mr ELTOBAJI, Andrew (ANSTO); Mr OLSEN, Scott (ANSTO); Dr DARMANN, Frank (ANSTO); Dr RUPPENDER, Hansjoerg (Omnivac)

Presenter(s) : Dr STAMPFL, Anton (Australian Nuclear Science and Technology Organisation)

Session Classification : Poster Session B

Track Classification : Vacuum Science and Technology