Performance Test on Neutron Polarization Analysis Capability of PELICAN –Time of Flight Cold Neutron Spectrometer

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The implementation of polarization analysis on a conventional time-of-flight spectrometer has been a major instrumental goal for some time. Here we present our recent results describing our successful test of the polarization analysis option on the PELICAN spectrometer. The compact incident neutron polarization system is an integration of a solid-state bender-type supermirror polarizer with a gradient radio frequency (RF) spin flipper. Polarization analysis is achieved by using a polarized ^{3}He neutron spin filter that covers a span of 120 degrees. The polarization analysis system is installed inside the high vacuum sample chamber through a dedicated aluminium vacuum adaptor flange. *In-situ* refilling of pre-generated polarized ^{3}He gas has been implemented.

The supermirror polarizer and spin flipper have been characterized with a Heusler crystal as the analyser for neutron wavelength of 4.68 Å. 95% polarization efficiency and 92% flipping efficiency have been obtained for the polarizer and spin flipper, respectively. It was found that the Fermi chopper had no depolarization effects. Further tests with the ^{3}He analyse ron a non-magnetic alumina sample achieved overall polarization efficiency of 82% and this gives 94% analysing power for a ^{3}He analyser filled with 1 bar of ^{3}He gas. The T_1 lifetime of the ^{3}He cell is about 100 hours. Nuclear-spin incoherent scattering on vanadium has been performed and the 2:1 ratio between the spin-flip and non-spin-flip signal has been observed. The energy resolution of the conventional spectrometer was maintained and approximately 80 % of the detector area is still useable. More details of the instrument performance and further improvement on polarization analysis will be presented.