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Neutron Polarisation Analysis Capability of PELICAN –A Time-of-Flight Cold Neutron Spectrometer

The implementation of polarisation 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 polarisation analysis option on the PELICAN spectrometer. The compact incident neutron polarisation system is an integration of a solid-state C-bender supermirror polariser with a gradient radio frequency (RF) spin flipper. Analysis is achieved by using a polarised ^3He neutron spin-filter that covers a span of 120 degrees. The ^3He analyser is installed inside the high vacuum sample chamber through a dedicated aluminium vacuum adaptor flange. In-situ refilling of pre-generated polarised ^3He gas has been implemented. The supermirror polariser and spin-flipper have been characterized with a Heusler crystal as the analyser for a neutron wavelength of 4.68 Å. 99% and 97% efficiencies have been obtained for the polariser and spin flipper, respectively. Further tests with the ^3He analyser on a non-magnetic alumina sample achieved overall polarisation efficiency of 90%, this gives a 94% efficiency for the ^3He analyser filled with 1.2 Bar of polarised gas. The T1 lifetime of the ^3He cell is approximately 100 hours. Nuclear-spin incoherent scattering measurements of Vanadium have 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.

Topic

Neutron Instruments & Techniques

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