



Contribution ID: 43

Type: not specified

Development of Polarized ^3He Neutron Spin Filters at Oak Ridge National Laboratory

Wednesday, 25 September 2019 09:00 (20 minutes)

Nuclear spin-polarized ^3He is widely used in many scientific areas. One of the applications is used as a neutron spin filter to polarize neutrons. Among all the neutron polarizing techniques, nuclear-spin-polarized ^3He neutron spin filters have shown great flexibility and versatility because of its highly spin-dependent neutron absorption cross section, large neutron acceptance angle and working over a broad neutron wavelength band. At the Oak Ridge National Laboratory, ^3He is routinely polarized via spin-exchange optical pumping (SEOP). Over the last several years, various SEOP-based systems have been developed to suit the needs of different neutron instruments at the Spallation Neutron Source (SNS) and the High Flux Isotope Reactor (HFIR). Particularly, great efforts have been made in developing in situ systems to address the problem of ^3He polarization decay in the drop-in cell setup. Because most instruments at SNS and HFIR have very limited space, the in situ system development has been focused on having a compact form factor design tailored to each individual beamline while still achieving high ^3He polarization. We report the development and optimization of polarized ^3He spin filters at ORNL and present the latest results.

Summary

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Session Classification: Polarized Neutrons

Track Classification: Polarized Neutrons