Development of compact laser optics for an in-situ spin-exchange optical pumping ^{3}He neutron spin filter

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We have been developing a ^{3}He neutron spin filter (NSF) for the efficient utilization of pulsed neutrons, since it can polarize neutrons effectively in a wide energy range. The ^{3}He NSF is effective even for neutrons with energy higher than several-tens-meV, so that it will be useful for the study of high-energy magnetic excitation. Since the ^{3}He NSF can also cover a large solid angle and polarize neutrons without deflecting them from their original course, it is suitable for the analyzer for SANS instruments and reflectometers. In addition, the ^{3}He NSF will be a key device in the application of recently developed magnetic field imaging technique by using polarized pulsed neutrons [1], since it can polarize a neutron beam with a large cross section without deteriorating projection image of the transmitted neutrons. In order to apply the ^{3}He NSF to experiments at a pulsed neutron experimental facility such as the J-PARC, it is important to make the system stable and easy to setup and operate, because the system is located inside a radiation shield for high energy gamma ray and neutrons. In this study, we have developed compact laser optics with a volume holographic grating (VHG) element for a spin-exchange optical pumping (SEOP) system, and composed an in-situ SEOP ^{3}He NSF. The design and performance of the in-situ SEOP ^{3}He NSF will be then presented, and its possible application will be discussed.

References

[1] T. Shinohara et al., NIM-A, Vol. **651** 121 (2011)