Construction of a Neutron Spin Filter System for Polarized Neutron Scattering Experiments at JRR-3

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Polarized neutron experiments are among the most effective methods in materials science, as they can distinguish between nuclear and magnetic scatterings and extract chiral terms. Polarized neutron scattering experiments using a Heusler monochromator have been conducted at JRR-3 in Tokai. However, the neutron energy bandwidth and the accessible wavenumber range are limited, especially in the low energy and *Q* regions. We plan to introduce a ^{3}He neutron spin filter (NSF) option at the 6G-TOPAN triple-axis spectrometer, utilizing the in-situ spin-exchange optical pumping (SEOP) method. In FY2023, we successfully introduced an in-situ polarization device for incident neutrons and confirmed that a high neutron polarization rate (~99.9%) can be achieved under typical experimental conditions for thermal neutrons [1]. Currently, a ^{3}He-NSF similar to the one for incident neutrons is being installed for post-scattered neutrons. We prepared components, including the fabrication of amplification circuits needed to flip the ^{3}He nuclear spin state and measure the polarization rate. This presentation will report on the current status of the system's introduction and the instrument's development. In addition, this presentation will include recent achievements from 6G-TOPAN [2-5].

[1] S. Takada *et al*., unpublished.

[2] M. Tsukagoshi *et al*., Phys. Rev. B **107**, 104425 (2023).

[3] Y. Shimizu *et al*., J. Phys. Soc. Jpn. **93**, 073701 (2024).

[4] Y. Umemoto *et al*., Mater. Trans. **64**, 2018 (2023).

[5] Y. Ikeda *et al*., J. Phys. Soc. Jpn. **93**, 091003 (2024).

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