We have developed a polarized $^3$He neutron spin filter (NSF) for a polarized neutron spectrometer POLANO at J-PARC Materials and Life Science Experimental Facility. POLANO is a newly constructed polarized inelastic neutron spectrometer, designed to utilize high-energy polarized neutrons over 100 meV and the spin analysis of scattered neutrons. The incident neutron beam is polarized by the NSF while the spin state of the scattered neutrons is analyzed by magnetic supermirrors.

The NSF is based on in-situ spin exchange optical pumping (SEOP) and placed in a limited space (60cm x 60cm x 25cm) of the spectrometer. It utilizes a non-magnetic flexible polyimide heater for alkali-hybrid SEOP to keep the NSF dimensions minimum. Polarized $^3$He can be spin-flipped by frequency sweep adiabatic fast passage, which simultaneously performs an NMR measurement, with minimal polarization loss. A diode laser array and a chirped volume Bragg grating emit ~70 W light at 794.7 nm with a FWHM of ~0.2 nm. A digital electron paramagnetic resonance (EPR) system, which consists of a PC, a USB oscilloscope, a photo sensor, and a coil, has been developed for $^3$He polarimetry using the Rb EPR frequency shifts.

**Figure:** Polarized $^3$He neutron spin filter for POLANO. A magnetically shielded solenoid with neutron guild coils, a diode laser array, optical components, and a low noise amplifier for NMR are enclosed in a laser shield box with dimensions of 60 cm x 60 cm x 25 cm for safety. A $^3$He cell in an oven is placed inside the magnetically shielded solenoid.

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We prefer a poster presentation.