Polarized Proton Solid Target at high-T and low-B

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Recent progresses in proton polarization at high temperature of > 77K and low magnetic field of < 0.3 T are reviewed. The proton polarization is achieved by transferring an electron polarization in photo-excited triplet states of aromatic molecules to protons, by means of a cross polarization method. The technique was first developed at Leyden University [1,2] and was applied to neutron beam irradiation experiments by Kyoto group [3]. We have recently introduced an Ar-ion laser for excitation of pentacene molecule and achieved the proton polarization of 37%[4] which is comparable to the value obtained with a dye laser used in Ref. [3].

We applied the proton polarization to a target system for radioactive isotope (RI) beam studies. RI beam experiments conducted under so-called 'inverse kinematics' condition require detection of low-energy recoiled protons for discrimination of proton scattering events. Here, smallness of magnetic rigidity of the recoiled proton makes the low-field operation of the polarized target crucial for the proton detection. We have achieved a proton polarization of ~20% for a target material of ϕ 14mm in area and 1mm in thickness. The target has been used in an RI beam experiment at RIKEN, where analyzing power for the p-⁶He elastic scattering has been measured at 71 MeV/u [5,6].

In the talk, overview of the polarized target system and results from the RI beam experiment will be presented.

- [1] H.W. van Kesteren et al., Phys. Rev. Lett. 55 (1985) 1642.
- [2] A. Henstra et al., Phys. Lett. A **134** (1988) 134.
- [3] M. Iinuma et al., Phys. Rev. Lett. 84 (2000) 171.
- [4] T. Wakui et al., Nucl. Instrum. Methods Phys. Res. A 550 (2005) 521.
- [5] M. Hatano et al., Euro. Phys. J. A 25 (2005) 255.
- [6] S.Sakaguchi et al. in SPIN2006.

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