Subject No: 7

MOMENTUM DEPENDENCE OF SPIN POLARIZATION FOR BETA-EMITTING NUCLEI PRODUCED THROUGH CHARGE EXCHANGE REACTION AT INTERMEDIATE ENERGY

S. Momota[1], M. Mihara[2], D. Nishimura[3], M. Fukuda[2], Y. Kamisho[2], M. Wakabayashi[2], K. Matsuta[2], S. Suzuki[4], M. Nagashima[4], Shengyun Zhu[5], Daqing Yuan[5], Yongnan Zheng[5], Ping Fan[5], T. Izumikawa[6], A, Kitagawa[7], S. Sato[7], M. Kanazawa[7], M. Torikoshi[7], T. Minamisono[2], Y. Nakamura[4], K. Tashiro[4], A. Honma[4], N. Yoshida[8], H. Shirai[8], T. Ohtsubo[4], T. Nagatomo[9], H. Uenishi[2], K. Iwamoto[2], M. Yaguchi[2], T. Ogura[4], T. Ito[4], K. Yamamura[10], Y. Ichikawa[8], Y. Nojiri[1], J. R. Alonso[11], and T.J.M. Symons[11]

[1]*Kochi Univ. of Tech., Kochi 782-8502, Japan,* [2] *Osaka Univ., Osaka 560-0043, Japan*
[3] *RIKEN, Saitama 351-0198, Japan*, [4] *Niigata Univ., Niigata 951-2181, Japan*
[5] *CIAE, Beijing 102413, People's Republic of China,* [6] *RI Center, Niigata Univ., Niigata 951-8510, Japan*
[7] *NIRS, Inage, Chiba 263-8555, Japan,* [8] *TIT, 2-12-1, Tokyo 152-8550, Japan*, [9] *J-PARC, Ibaraki 319-1195, Japan,*
[10] *Fukui Univ. of Tech., Fukui 910-8505, Japan*, [11] *LBL, Berkeley, CA 94720, USA*
momota.sadao@kochi-tech.ac.jp

Polarized beta-emitting nuclei are valuable probes to study HF fields of materials by applying β-NMR technique. For efficient and precise studies, it is necessary to prepare beta-emitting nuclei with large nuclear polarization and high purity. In case of proton-rich β-emitting nuclei, it is expected that charge exchange reaction would have an advantage to reduce contaminations to realize high purity. In the previous study [1], nuclear polarization of proton-rich β-emitting nuclei ^{28}P was produced through charge exchange reaction at E=100 MeV/u. According to observed nuclear polarization and momentum distribution, it was suggested that two different reaction mechanisms, knockout and pickup-abrasion process, would contribute to polarization phenomena in charge exchange reaction.

In the present study, nuclear polarization of ^{28}P was produced though charge exchange reaction ^{28}Si+^{9}Be at E=100 MeV/u by selecting longitudinal momentum (p_L) and ejecting angle. Produced nuclear polarization was observed as β-ray asymmetry (AP) by applying β-NMR technique. As shown in Fig. 1(a), observed AP shows remarkable p_L dependence. At higher p_L, where knockout process would be dominant to include the primary peak of p_L distribution shown in Fig. 1(b), small AP was observed. At lower p_L, where pickup-abrasion process would be dominant, AP shows drastic increase. In addition, transverse momentum (p_T) distribution of ^{28}P was observed as angular distribution. The dispersion of p_T distribution (σ_T) increases at lower p_L. This behavior supports p_L dependent contribution of two reaction mechanisms to nuclear polarization phenomena.

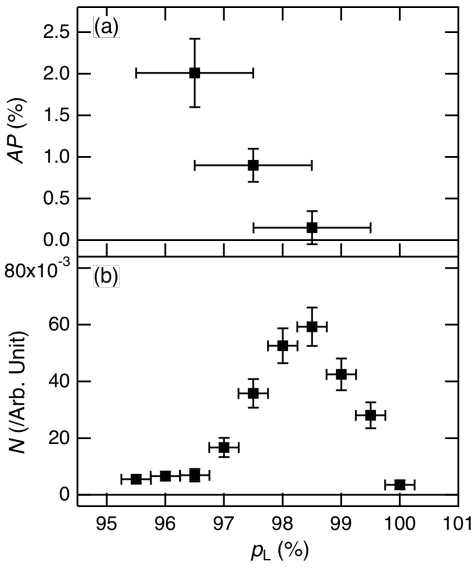

Fig. 1. p_L dependence of observed AP and p_L distribution of ^{28}P

References

[1] K. Matsuta et al., Hyperfine Interact. 198 (2010), 147