Proc. Sixth Int. Symp. Polar. Phenom. in Nucl. Phys., Osaka, 1985
J. Phys. Soc. Jpn. 55 (1986) Suppl. p. 728-729

1.88 Vector and Tensor Analyzing Powers in (d,^{6}Li) Reactions on ^{12}C and ^{16}O

Y. Tagishi, Y. Aoki, K. Hashimoto, M. Takei, M. Kurokawa,
T. Murayama, T. Sakai, M. Tomizawa and K. Yagi

Institute of Physics and Tandem Accelerator Center,
University of Tsukuba, Ibaraki 305, Japan

We report here results of measurements of the vector and tensor analyzing powers in the reactions ^{12}C(d,^{6}Li)^{8}Be(g.s.) and ^{16}O(d,^{6}Li)^{12}C(g.s.) induced by vector and tensor polarized deuteron beams. A number of measurements on direct (d,^{6}Li) reaction cross sections have been made earlier. However, no measurements of the tensor analyzing powers for the direct (d,^{6}Li) reaction have been published. The purposes of the present experiment are to get further informations of the cluster structure of the ^{6}Li than those obtained from only cross-section data and to what extent the analyzing powers can be described by the alpha-cluster pickup mechanism.

The experiment was performed with 22 MeV polarized deuteron beam from a tandem accelerator using a Lamb-shift polarized ion source at the University of Tsukuba. The emitted particles are momentum analyzed by the magnetic spectrograph and detected with 5-cm long Si position sensitive detector placed on the focal plane. The ^{6}Li particles are identified by their energy signals in the detector. The vector and tensor analyzing powers are obtained by measuring each cross sections of the incident deuteron beams with m_I=+1, 0 and -1 magnetic sub-states for three particular orientations of the spin alignment axis. The observed data are shown in fig. 1.

We compared these data with the finite-range DWBA calculations assuming one-step alpha-cluster transfer by using a computer program TWOFNR[1]. The relative motion wave function of the alpha and deuteron in ^{6}Li introduced by Kubo and Hirata[2] is used in the present calculations. The solid curves in fig. 1 represent the DWBA predictions including the L=2 component with amplitude derived by Nishioka et al.[3] which is chosen to reproduce the experimental ^{6}Li quadrupole moment. While for the dashed curves in fig. 1 the L=2 state effects are neglected. Calculated cross sections are normalized to the data. The deuteron optical-model potential parameters are derived from the analysis of the cross sections and vector analyzing powers from deuteron elastic scattering on ^{12}C and ^{16}O at 22 MeV. For the ^{6}Li particle, we adopt the potential set which is obtained from the analysis of elastic scattering of ^{6}Li by ^{9}Be and ^{12}C in Ref. 4. The shapes of the angular distributions of the cross sections and vector analyzing powers are fairly well reproduced by the DWBA calculations except very forward angles in ^{16}O target. The observed large values of the tensor analyzing powers are not predicted by the DWBA calculations assuming a single step alpha transfer process at all. The small amount of the L=2 component produces only small changes in the tensor analyzing powers in the present calculations. The present tensor analyzing power measurements should indicate more complicated reaction mechanisms. Preliminary calculations are made for the ^{12}C(d,^{6}Li)^{8}Be reaction including the effects of the second order processes such as the inelastic two-step processes (d,d')(d',^{6}Li) and sequential processes (d,α)(α,^{6}Li) in the zero-range approximation. It was found that the two-step processes cause changes in the analyzing powers at the minimum of the cross sections. However these calculations also predict only small value of the tensor analyzing powers.

References

1) Computer code TWOFNR by M. Igarashi
2) K.-I. Kubo and M. Hirata, Nucl. Phys. A187 (1972) 186
3) H. Nishioka, J. A. Tostevin and R. C. Johnson, Phys. Lett. 124B (1983) 17
4) J. E. Poling, E. Norbeck and R. R. Carlson, Phys. Rev. C13 (1976) 648

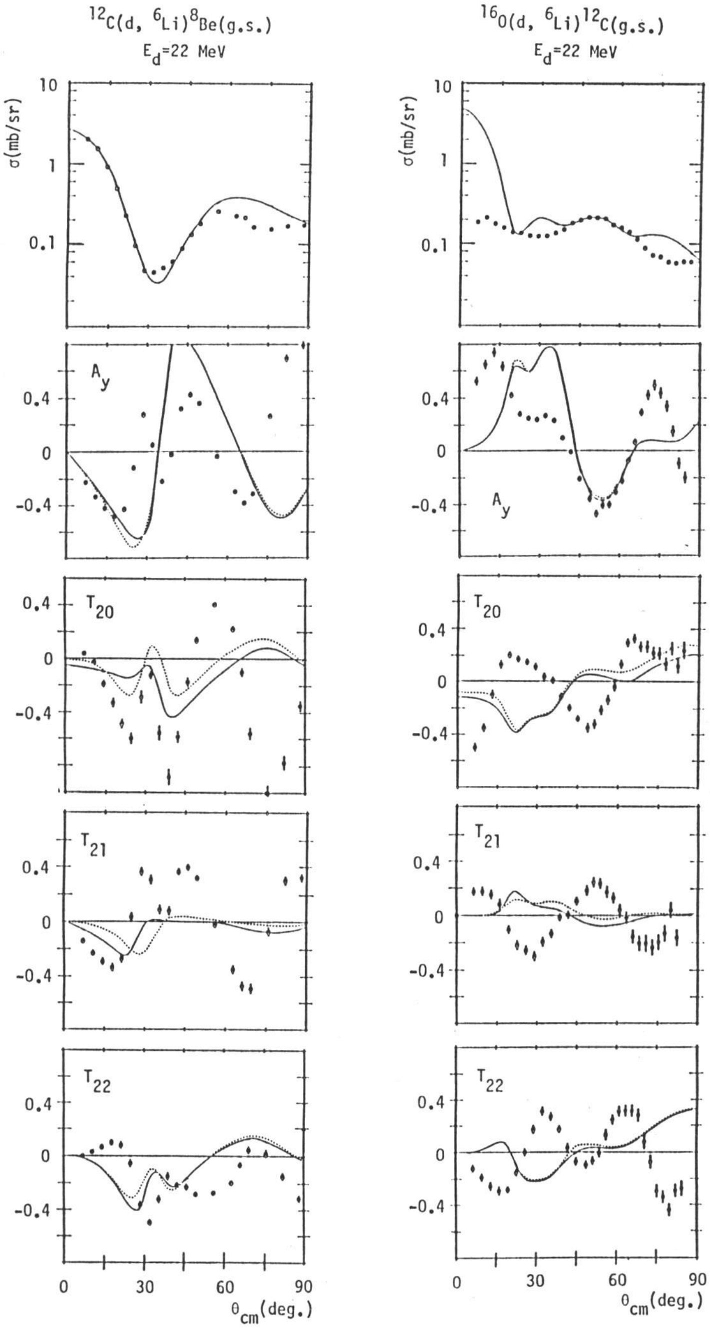

Fig. 1. Cross sections and analyzing powers in (d,^{6}Li) reactions on ^{12}C and ^{16}O at E_d=22 MeV. The solid curves are finite-range DWBA calculations which include the L=2 component in the relative motion of the deuteron and alpha clusters in ^{6}Li while for the dashed curves the L=2 component effects are neglected.