

Competing Interactions in Two Dimensional Square Lattice $\text{CuSb}_{2-x}\text{Ta}_x\text{O}_6$

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CuSb_2O_6 compound has a tri-rutile type structure in which Cu^{2+} ions form a square lattice [1]. The magnetic susceptibility of CuSb_2O_6 indicates a typical behavior for $S=1/2$ one-dimensional Heisenberg anti-ferromagnet above 20K and shows a anti-ferromagnetic (AF) long-range order at 8.7 K in which Cu spins are aligned ferromagnetically along b-axis (namely collinear order) with a propagation vector $(1/2, 0, 1/2)$ [2, 3]. If nearest neighbor coupling J_1 is too stronger than next nearest coupling J_2 along diagonal, Neel order will be stabilized. Then J_2 interaction through Cu-O-O-Cu bond is dominant on the collinear order of CuSb_2O_6 . The substitution of Ta atom instead of Sb atom causes the decreasing of transition temperature of long-range order which disappears above $x=1$ [4]. TaO_6 octahedron occupies inter CuO layers and the inter layer coupling may be decreased with the substitution of Ta atom; x . In this reason we can study the J_1 and J_2 couplings about CuO layer only at the compound with $x=1$. When J_2 coupling is AF, there are the spin frustrations between J_1 and J_2 couplings even if J_1 coupling is ferromagnetic or AF [5].

The results of first neutron inelastic scattering measurements of CuSbTaO_6 powder samples were reported at last year (#461, #464) that the magnetic spin gap was observed at 0.8 meV with the use of PONTA (5G) spectrometer. High energy resolution experiments were done for the confirmation of the spin gap by the cold neutron triple-axis spectrometer HER (C11) installed at the JRR-3M reactor at JAEA. Magnetic excitation peak was observed at $Q=0.6\text{\AA}^{-1}$ for constant $E=0.4$ meV, 1.0 meV and 1.4 meV scans at the temperature 5K as shown in figure 1. The spin gap in magnetic scattering could not be observed with the energy resolution 0.14 meV. This re-

sult indicates that CuSbTaO_6 is typical one-dimensional magnetic substance. The peak position along Q is near 0.6\AA^{-1} in deviation from the expected value 0.4735\AA^{-1} in Cu-O-O-Cu chain.

References

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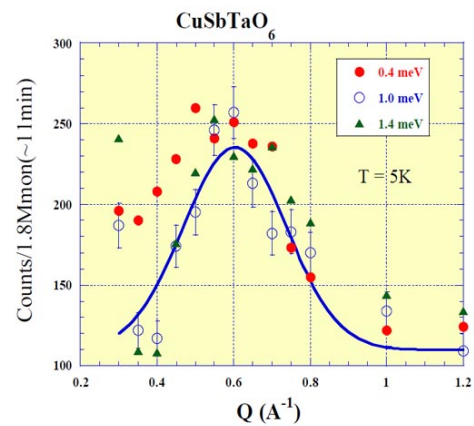


Fig. 1. The experimental results of CuSbTaO_6 powder sample by the cold neutron-scattering. Magnetic spin gap was not observed and the peak by anti-ferromagnetic correlation was observed at several constant E-scan.