Magnetic Properties of Honeycomb System Na2Co2TeO6

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Na2Co2TeO6, has Co2TeO6 layers, consisting of edge-sharing CoO6- and SbO6-octahedra with Na layers between them. The Co2+ ions are considered to have high spin state S=3/2. For this system, polycrystalline samples of Na2Co2TeO6 were prepared, and their magnetic susceptibility and specific heat were first measured, where clear anomalies due to the antiferromagnetic transition1) were found in the temperature dependences of these quantities at TN=23.7 K. The magnetic susceptibility data have been analyzed using the high temperature expansion method, and the first-, second- and third-neighbor interactions J1, J2 and J3 among the spins are estimated to be 11.4 ± 0.5 K (Ferro), -4.1 ± 0.1 K (AF) and 0.3 ± 0.1 K (Ferro), respectively. Based on the J1/J3-J2/J3 phase diagram of Heisenberg spin system proposed by Fouet et al.,2) the magnetic structure of this system is expected to be screw type one. To see if the structure is actually found in this system, neutron scattering measurements were carried out using the triple axis spectrometer HQR (T1-1), where the double axis condition was adopted. At T=4 K, we observed the magnetic reflections at commensurate Q-points. Figure shows the T-dependence of the integrated intensity of 1 0 1 magnetic reflection. From the figure, the magnetic ordering is found to grow with decreasing T below TN. By the preliminary analyses of the neutron scattering data, the magnetic structure which can reproduce the observed magnetic scattering intensities at 4 K is obtained (shown schematically in the inset of the figure). The details of the obtained structure at 4 K can be described as follows. The collinear ordering of the Co2+ moments can be found with the moment direction parallel to the c-axis. In the honeycomb layer, the one-dimensional zig-zag ferromagnetic chains exist and these ferromagnetic chains order antiferromagnetically. The discrepancy between the predicted and actual magnetic structure of Na2Co2TeO6 seems to be originated from the anisotropy of the Co2+ spins with strong Ising anisotropy.

References

[1] Y. Miura et al.: J. Phys. Soc. Jpn. 75 (2006) 084707.
[2] J.B. Fouet et al.: Eur. Phys. J. B 20 (2001) 241.

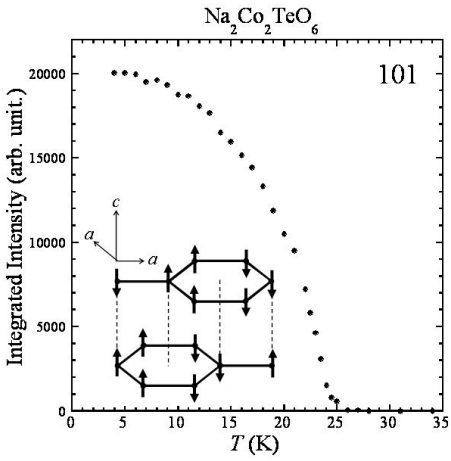

Fig. 1.