Determination of the magnetic structure of Cu3Mo2O9 showing weak ferromagnetism in magnetic fields

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We found two unique magnetic properties in orthorhombic $Cu_3Mo_2O_9$ (*Pnma*) having two spin subsystems, antiferromagnetic (AF) spin uniform chains and AF spin dimers [1,2]. Spins on Cu1 sites form the AF chains parallel to the *b* axis. Spins on Cu2 and Cu3 sites form the AF dimers in the *ac* plane. The two unique magnetic properties are the canted AF magnetic order stabilized only in finite magnetic fields [1] and the disappearance of the spontaneous magnetization caused by a small amount of Zn substitution into Cu sites (0.2% Zn) [2]. We consider that the two unique magnetic properties originate in magnetic frustration. We performed inelastic neutron scattering experiments on a single crystal, observed magnetic excitations, and determined dispersion relations [3]. We could explain the dispersion relations using the coupled AF chain and dimer model. In order to understand magnetism of $Cu_3Mo_2O_9$, it is necessary to determine the magnetic structure. Therefore, we performed neutron diffraction experiments on a single crystal of $Cu_3Mo_2O_9$ in the zero magnetic field using the FONDER diffractometer. We infer the following magnetic structure. The *b* component of the Cu1 spin is the major component and forms the AF chain. Small *a* and *c* components are the canted components. The Cu2 and Cu3 spins are intrinsically spin singlet because of the AF dimer. However, the Cu2 and Cu3 spins must have magnetic moments caused by the internal magnetic fields generated by the Cu1 magnetic moments. There are 12 Cu sites and 36 components of the magnetic moments in the unit cell. Therefore, refinements of the magnetic structure are not so easy. We are now performing refinements of the magnetic structure.

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