Magnetic correlation at Wannier point in isosceles-triangular lattice Ising magnet $CoNb_2O_6$

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Recently, we have studied an isosceles triangular lattice Ising magnet $CoNb_2O_6$ along the context that if the ratio of exchange interactions defined as $\gamma = J_1$ (along the base direction) $/J_2$ (along the equilateral direction) can be controlled via anisotropic deformation of isosceles triangular lattice (ITL) by uniaxial pressure, variety of interesting magnetic features intrinsic to γ would be observed [1]. Actually along this context, we succeeded in crossing the Wannier point ($\gamma = 1$) by applying the c axis-uniaxial pressure $p \parallel c$ up to 1 GPa, as is in the experimental reports of No.1802 and No.1841. As a continuation of the proposal, using the two-axis diffractometer E4 installed at the Berlin Neutron Scattering Center in the Helmholtz Centre Berlin for Materials and Energy, we tried to provide access to Wannier point by applying the b axis uniaxial pressure $p \parallel b$ up to 1GPa, because almost flat diffraction profile in $(0k0)$ scan can be seen at $p \parallel b \sim 0.6$ GPa ($\gamma \sim 1$) and suggests good "spot" as is in the experimental reports of No.1913.

As shown in Fig.1, switching from AF-II magnetic ordering to AF-I magnetic ordering at $p \parallel b \sim 0.6$ GPa is not sharp but rather broad in contrast to that at $p \parallel c$ ~0.8 GPa. At the same time, with increasing the b axis uniaxial pressure $p \parallel b$, AF-II-2(+) magnetic ordering start to appear, and shows its maximum at $p \parallel b \sim 350$ MPa, and decreases in synchronized with AF-II magnetic ordering. Taking into account that AF-II-2(+) magnetic structure with doubling along both the a and the b directions is stabilized under unequal coupling constants J_2 along equilateral direction of ITL, unfortunately, the b axis-uniaxial pressure produced by our transverse-pressure device in present measurement seems to be in-homogenous and to deviate from the b-axis direction so as to break the equality in J_2 along equilateral direction of ITL.

[1] S. Kobayashi et al., Phys. Rev. B 90, 060412(R).

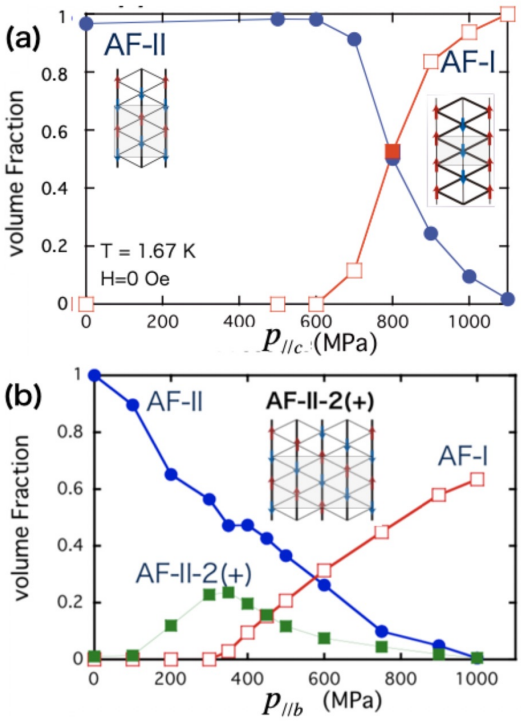

Fig. 1. (a) The c-axis pressure dependence of volume fraction of AF-I, AF-II magnetic orderings, (b) the b-axis pressure dependence of volume fraction of AF-I, AF-II and AF-II-2(+) magnetic orderings.