Magnetic fluctuation at the Wannier point in isosceles triangular lattice Ising magnet $CoNb_2O_6$ (continuation)

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An isosceles triangular lattice Ising antiferromagnet is characterized by the ratio of exchange interactions defined as $\gamma = J_1$ (along the base direction) $/J_2$ (along the equilateral direction), and its magnetic property dramatically changes, depending on whether γ is larger than 1.0 or not. As one of the model materials, we have been studying an Ising magnet $CoNb_2O_6$, where the quasi-1D ferromagnetic zigzag chains along the *c* axis form a frustrated antiferromagnetic isosceles-triangular lattice (ITL) with $\gamma \simeq 1.33$ in the *a*-*b* plane. If the exchange ratio γ can be controlled in $CoNb_2O_6$ via anisotropic deformation of ITL by uniaxial pressure, a variety of interesting magnetic features intrinsic to γ would be observed. Actually, along this context, in previous neutron experiments, we have found that the magnetic ground state AF-II magnetic ordering with q=1/2 is switched to AF-I magnetic ordering with q=0 at the Wannier point (γ=1) with critical pressure $p_c \simeq$ 700 MPa, by applying uniaxial pressure p up to 1GPa along the *c* axis.

The present experiment, conducted using the C1-1 HER spectrometer (E_f = 1.55 m eV), is a continuation of the previous quasi-elastic scattering experiment (No. 23541). In that experiment, when the Bragg magnetic peak in the IC phase was energy-resolved, we found that the Bragg magnetic scattering itself exhibited magnetic fluctuations with a finite linewidth exceeding the elastic energy resolution. Furthermore, when uniaxial stress was varied up to 700 MPa, the linewidth increases toward the Wannier point (γ = 1). (See Fig. 1 of Report No. 23541.) The objective of the present experiment was to investigate the change of this linewidth by further increasing the uniaxial stress from p = 700 MPa, where the Wannier state can be realized, to 1GPa.

In conclusion, the present experiment, which used the identical sample as in the previous experiment (No. 23541), unfortunately failed to obtain the expected results due to the degradation of the sample. At p = 0 MPa, the Bragg magnetic scattering intensity of the IC phase (including nuclear scattering intensity) was reproducible within the experimental accuracy. However, upon applying uniaxial stress, the magnetic wave number q exhibited significant distribution at $p \geq$ 500 MPa, rendering the energy-resolving magnetic Bragg peak of the IC phase with its characteristic magnetic wave number q no longer meaningful. The IC phase is not a long-range ordered phase like the AF-II phase or AF-I phase at low temperatures, but rather a dynamic phase with fluctuations, and it is considered to be subject to pinning effects caused by defects. During the 1.5-year sample storage period, the sample may have undergone degradation accompanied by defects.

Applying a pressure of p = 700 MPa or higher is expected to move the system away from the Wannier point and suppress magnetic fluctuations. As supporting evidence, the decrease in the quasi-elastic scattering component coexisting with the AF-1 magnetic Bragg peak, which has a resolution limit as mentioned in Fig.2 of the previous report, can be seen in Fig. 1.

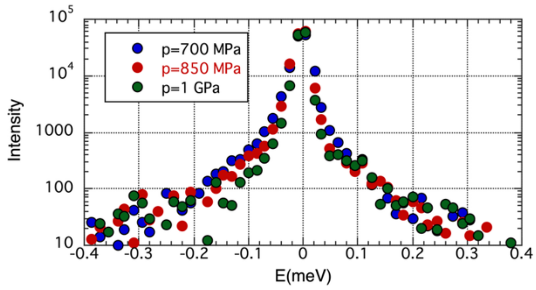

Fig. 1. Energy scan profile at (100) AF-I Bragg point