Overall observation of magnetic excitations in multiferroic $TbMnO_3$

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$TbMnO_3$ is known as a representative multiferroic material endowed both ferroelectric and magnetic orders. It possesses the *bc* spiral spin structure below 28 K, where the spins of Mn ions rotate within the *bc* plane with the propagation vector $\boldsymbol{q}$ = (0 q 1) (q ~ 0.27). The spin arrangement generates ferroelectric polarization P along the c axis. The coupling between ferroelectricity and magnetism would produce the intriguing lower-lying spin excitation referred to as electromagnon. It is magnetic in origin, but it becomes active in response to the electric field component of light. Recently, several groups have measured the optical spectra of $TbMnO_3$ and found peak structures in the imaginary part of ε_2 at E ~ 2.5, 7.5, and 17 meV in the ferroelectric phase [1, 2]. In order to clarify the origin of these excitations, it is imperative to obtain the whole picture of magnetic excitation in this material. Early inelastic neutron scattering studies were performed in narrow reciprocal space region and therefore mode assign is based on oversimple hypothesis [3].

In this study, we have performed inelastic neutron scattering experiment in wide reciprocal space region to obtain circumstantial information of magnetic excitation in the *bc* spiral ferroelectric phase. Inelastic-neutron-scattering spectra was observed with the time-of-fright technique by using “4SEASONS” spectrometer at J-PARC, Japan. Five single crystals grown by a floating-zone method were aligned and attached to an aluminum cell. Observed data was analyzed with UTSUSEMI which is a program for four-dimensional data analysis. Obtained magnetic dispersions are consistent with those previously reported. Microscopic picture of the magnetic excitations would be presented in the poster session.

References

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