Performance of triple axis spectrometer HQR at T1-1

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Triple axis spectrometer HQR at T1-1 beam hole in the guildhall is a general-purpose instrument for solid state physics and materials science. The operation of HQR is mainly commissioned by Ibaraki Univ. Gr. since 2021, under the agreement with ISSP to use the instrument in regular lectures for student education of Ibaraki Univ. as well as research activities. Further, this framework also contributes to development of human resources in the community of neutron science. Hereafter, we report current status/performance of HQR.

Fortunately, we succeeded in operating the instrument without any serious problem, despite the shutdown of JRR-3 for 10 years. The spectrometer parameters are as follows: the monochromator and analyzer are PG 002 with a vertical focusing system. The incident energy is fixed at 13.57 meV (λ = 2.455 Å) with $2\theta_M$ = 42.9°. Sample scattering angle range is -90° < 2θ < 150°. A typical energy resolution for inelastic scattering is 0.68 meV for the collimator configuration Guide-40'-40'-60', where the effective collimation of the beam guide is expected to be 48'.

Figure 1 shows demonstration data of inelastic scattering spectra of phonon of Cu around the (0, 2, 0) reciprocal point. TA and LA modes are clearly observed. The dispersion is well consistent with reference.

Figure 2 shows a powder diffraction pattern of Al_2O_3 at room temperature. The result of Rietveld analysis based on the known crystal structures reproduce satisfactorily the measured data. We also observed the magnetic transition of MnO at ~120 K with the crystal structure distortion, which asserts reliability of the instrument.

Experiments for low-temperature magnetic properties of single crystals with dimension of approximately 1 mm were also conducted using the ^{4}He or the ^{3}He cryostats. Magnetic orderings associated with correlated electrons of Nd- and Eu-based compounds were clearly observed [1, 2]. These results indicate that HQR retains sufficient performance to investigate static and dynamical properties of condensed matters.

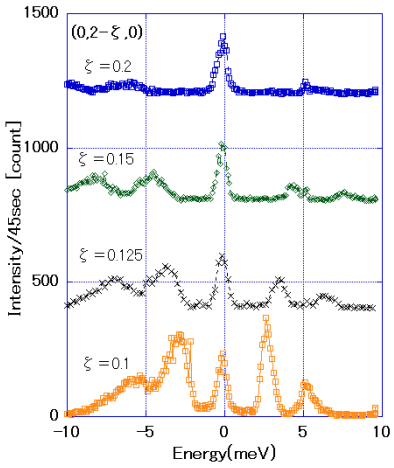

Fig. 1 Energy spectra of phonon of Cu. Two phonon modes are clearly observed.

The present study was carried out under the approved proposal No. 21408.

[1] A. Shimoda et al., submitted to JPS Conf. Ser.
[2] K. Iwasa and T. Kumada, in this Activity Report.

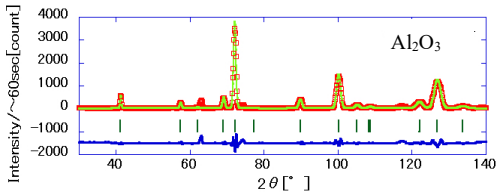

Fig. 2 Powder patterns of Al_2O_3, with results of Rietveld fitting.