

Inelastic X-ray Scattering of $\text{SmRu}_4\text{P}_{12}$

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We have carried out inelastic x-ray scattering of $\text{SmRu}_4\text{P}_{12}$ at room temperature. We have investigated the phonon dispersion of this material below 40 meV at BL35XU of SPring-8. We have used Si(11 11 11) backscattering reflection as a high resolution monochromator. The energy resolution of this setup is about 1.5 meV. The sample used is a single crystal prepared with Sn-flux method. The volume of the sample is about 1 mm³. We observe acoustic modes and q-independent modes like an optical mode along [1 0 0], [1 1 0] and [1 1 1] directions. The q-independent modes cross the acoustic modes. These are observed around 9 meV, 18 meV and 27 meV. This agrees with the excitation energy observed ¹⁴⁹Sm inelastic nuclear resonant scattering (INRS). The ratio of the integrated intensity in each excitation of the q-independent modes also agrees with the results of ¹⁴⁹Sm INRS within the experimental error. This indicates that the q-independent modes are caused by the Sm motion in P cage and that the acoustic modes are correlated only with Ru and P atoms in this material.