Martensitic Transformation is known to be typical first-order transformation. TiNi(Fe) alloy system, some of Ni atoms were replaced by Fe, has been studied for long time from fundamental point of view and application point of view. Alloy composition close to Ti50Ni47Fe3 was used for the studies of the martensitic transformation mechanism because of small hysteresis. Recently, high Fe composition alloy was reported that the alloy shows second-order-like transformation in resistivity measurements and calorimetric measurements. The alloy Ti50Ni44Fe6 was studied previously and reported that diffuse scattering appeared around 1/3 of (110) (incommensurate) at 200 K and approached to commensurate position with lowering temperature (180 K). Electrical resistivity showed minimum value at 209 K. Inelastic neutron scattering measurements were performed on this composition alloy and showed minimum phonon energy at 200 K. On the other hand, the alloy Ti50Ni42Fe8 studied in this experiment showed incommensurate transformation and does not show commensurate transformation on further cooling. This behavior may relate to the martensitic transformation and immediate study was required.

Ti50Ni42Fe8 alloy was grown by floating zone method. The single crystal sample was obtained by heat treatment at 1283 K for 24 h and quenched. Electrical resistivity of this alloy shows minimum temperature at 179 K. Inelastic neutron scattering experiments were performed at the triple-axis spectrometer 5G-PONTA. Initial energy of neutron was 14.7 meV and collimators used were 40°-40°-sample-40°-40°. Measured phonon mode was [zz0]TA2 at various temperatures. Figure shows E-const measurements at q=(0.25, -0.25, 0) around (120) reflection at various temperatures. The phonon energy decreases with lowering temperature. Approaching to z=1/3 and above, phonon peaks became broader, that is, over-damping was occurred. It is not clear the reason of the over-damping. The precise analyses have been undertaken for obtaining relationship between the phonon and transformation behavior.