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Low-energy lattice dynamics of relaxor-like PFN-38%PT by inelastic neutron scattering

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Piezoelectric crystals of the Pb(Fe1/2Nb1/2)1-xTixO3 (PFN-xPT) system have drawn much interest in recent years, due to relatively high Curie temperatures and potential multiferroic properties. By substitution of Fe3+/Nb5+ by Ti4+, the magnetic properties are suppressed: the Néel temperature TN decreases rapidly with the Ti content and the Curie temperature TC increases almost linearly. Moreover, at about x ~ 0.12, PFN-xPT possesses a morphotropic phase boundary (MPB) between the monoclinic and tetragonal ferroelectric phases. Recently, a polarized Raman study [1] of the PFN-38%PT single crystal reported significant crystalline anisotropy similar to that of tetragonal PbTiO3.

In this contribution, we will present our inelastic-neutron-scattering results of lattice dynamics of the PFN-38%PT single crystal in the cubic and tetragonal phases, mainly with respect to the temperature behaviour of the TO soft mode around the phase transition, and the TA-TO coupled-mode analysis in different Brillouin zones and directions. Further the comparison with the end-members of the PFN-xPT series, pure PbTiO3 [2-5] and Pb(Fe1/2Nb1/2) [6], will be discussed.

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