Wide Relaxation Time Distributions of Quasi-Elastic Neutron Scattering in relaxor ferroelectrics

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Relaxor ferroelectrics have gained much scientific and industrial attention due to their extremely high piezoelectric and dielectric responses in a wide temperature range [1]. These materials also exhibit a remarkable dielectric frequency dispersion that extends over 10 orders of magnitude in frequency [2]. The characteristic features of relaxors have been attributed to randomly-oriented polar nanoregions (PNRs), which are local regions of ferroelectric order that are roughly several tens of nanometers in size.

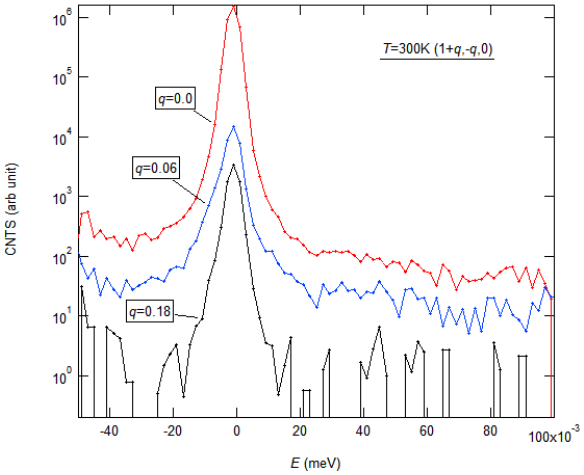

Fig. 1 Q dependence of quasi-elastic neutron scattering at T=300K at (1+q,-q, 0).

In order to study the relaxation processes of PNRs, we have measured quasi-elastic neutron scattering in relaxor ferroelectric 0.63($Pb(Mg_{1/3}Nb_{2/3})O_3$)-0.37($PbTiO_3$) by using the TOF type Si crystal analyzer near backscattering spectrometer ”DNA” installed at BL02 of Materials and Life Science Experimental Facility in the J-PARC. Figure 1 shows Q dependence of quasi-elastic neutron scattering (QENS) near (100) Bragg point measured at T=300K. Near q=0, we observed narrow QENS with half-width-at-half-maximum (HWHM: Γ) of ~20 μeV. In addition, broad QENS with Γ of a few hundreds μeV coexists, which are observed as higher intensities at ~100μeV. These QENS indicate wide relaxation time distributions, which is consistent with the dielectric susceptibility measurements. The Q-dependence of the distribution function B(Q,Γ) will be discussed.

References

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