Diffuse scattering study in the relaxor ferroelectric $(Na_{1-x}K_x)_{0.5}Bi_{0.5})TiO_3$ near morphotropic phase boundary

M. Matsuura[1], K. Hirota[2], Y. Noguchi[3], and M. Miyayama[3]

[1] *IMR, Tohoku University, 2-1-1, Katahira, Sendai, 980-8577.*

[2] *Department of Earth and Space Science, Faculty of Science, Osaka University, Toyonaka, 560-0043.*

[3] *Institute of Industrial Science, The University of Tokyo, 4-6-1 Komaba, Meguro-ku, Tokyo 153-8505*

Relaxor ferroelectrics have attracted considerable attention since the discovery of giant piezoelectricity in relaxor-based single crystals. Recently, $(Na_{0.5}Bi_{0.5})TiO_3$ (NBT) regains attention as promising applications to piezoelectric devices containing no toxic lead [1]. NBT exhibits extremely high and broad peak in the dielectric susceptibility which is very similar to that in typical relaxors. In addition, solid solution of NBT and $(K_{0.5}Bi_{0.5})TiO_3$ (KBT) shows the so-called morphotropic phase boundary at 0.8NBT-0.2KBT [1], which is important for industrial application because dielectric and piezoelectric responses become maximum at MPB. It is widely believed that the polar nanoregions (PNR) play an important role in relaxor behavior occurring at temperatures much above T_c. Such short-ranged atomic shift in PNR has been observed as diffuse scattering. [2] In order to study the atomic shift in PNR near MPB for NBT-KBT system, we study Q-pattern of diffuse scattering using the triple-axis spectrometers PONTA installed at the JRR-3 Reactor of the JAEA.

Figure 1 shows intensity contours of the diffuse scattering near (110) measured at room temperature for 0.8NBT-0.2KBT and (b) 0.6NBT-0.4KBT. The diffuse scattering observed for 0.8NBT-0.2KBT, rhombohedral side of MPB, elongates along the [100] and [010] directions, while that for 0.6NBT-0.4KBT, tetragonal side of MPB, shows intensity along $[1\bar{1}0]$ direction. Such change in Q-pattern of the diffuse scattering indicates a change in the short-ranged atomic shift in PNR across MPB.

References

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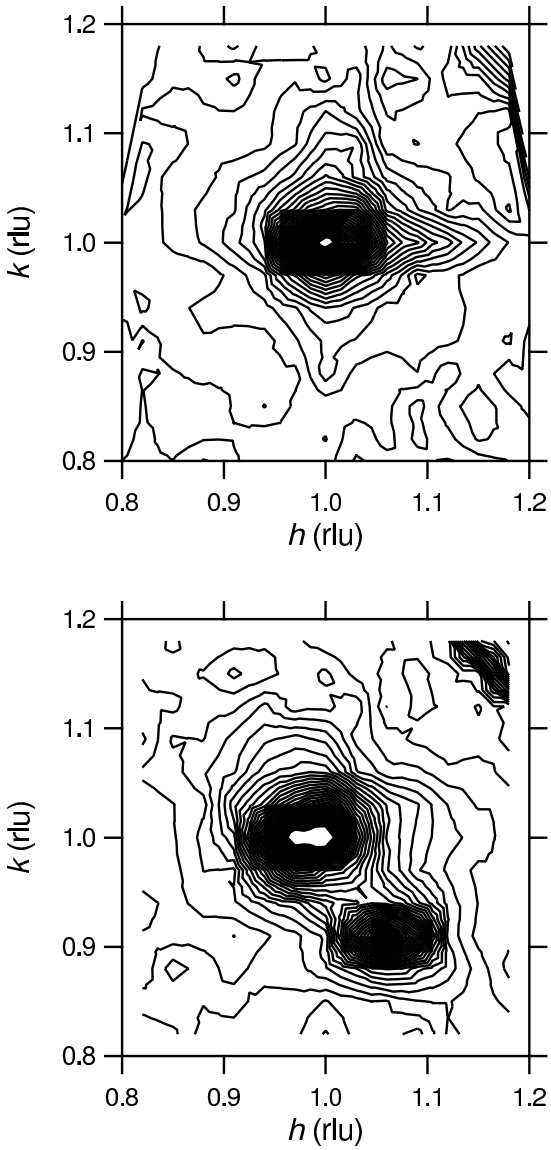

Fig. 1. Intensity contours of the diffuse scattering near (110) for 0.8NBT-0.2KBT and (b) 0.6NBT-0.4KBT measured at room temperature.