

Nuclear diffuse scattering in triangular lattice system LuFeCoO₄ with relaxor-like behavior

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In relaxor systems, temperature dependence of the dielectric permittivity shows a broad maximum and a frequency-dependence. [1] Since the relaxors have a high dielectric constant around room temperature, they are industrially important. To explain physical behaviors of relaxors, Burns proposed the ideas that randomly oriented, very local polar regions start to appear from high temperature. [2] This "Polar Nano Region" (PNR) is said to be the most important concept to understand the origin of the relaxor properties.

As a new example of such relaxor systems, we have studied the triangular lattice system LuFeMO₄ (M=Cu, Mg, and Co). For LuFe₂O₄, a ferroelectricity induced by a charge order has been observed. LuFeMO₄, in which M is randomly substituted at the Fe site, shows the relaxor-like behavior in the dielectric constant. [3] Relaxor-like dielectric property has hardly ever been reported in a triangular lattice system. In this study, we use a neutron scattering technique to examine the origins of the relaxor-like behavior in LuFeCoO₄.

At T=300 K, we have observed the anisotropic nuclear diffuse scattering around the Bragg reflection. Figure 1 shows a contour plot of the intensity distribution around the Q-point (1,1,0) for the scattering plane (hhl). Here, we use the hexagonal unit cell. This diffuse scattering is similar to the well-known butterfly pattern reported in PbMg_{1/3}Nb_{2/3}O₃ (PMN), where the diffuse scattering intensity extends along the [110] and [1-10] directions of the cubic symmetry. [4] However, the direction of the diffuse scattering in LuFeCoO₄ is not easy. Furthermore, the T-dependence of the intensity of the

anisotropic diffuse scattering along [110] is different from that along [001] although the intensities along both directions decrease with increasing T. Since the T-dependence of the dielectric constant along c-axis is also different from that along c-plane, it is expected that the anisotropic diffuse scattering has the relation with the relaxor-like behavior.

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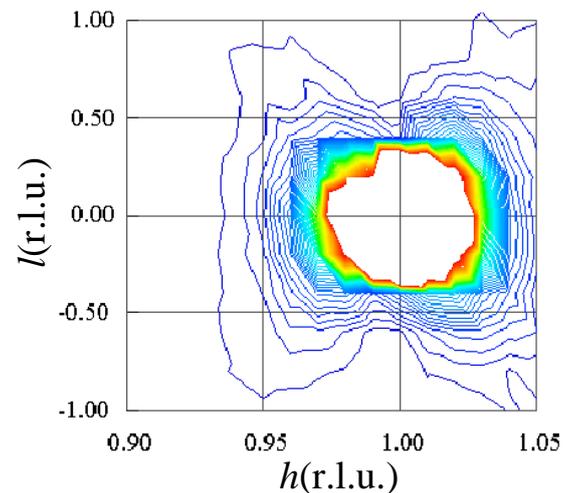


Fig. 1. Fig. 1 Contour plot measured around the Q-point (1,1,0) at 300 K for the scattering plane (hhl).