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Report:

The dielectric properties of $CaMn_7O_{12}$ depend on temperature. The values of the dielectric constant ε are vary large above 250 K (between 10^3 and 10^6). Below 150 K the values of ε vary between 10^1 and 10^2 [1].The size of the dielectric constant jump depends on the materials microstructure. For ceramic $CaMn_7O_{12}$ samples with larger grains (≈1.0 μm) there is a jump by 4 orders of magnitude [1]. For ceramic $CaMn_7O_{12}$ samples with smaller grains (≈0.4 μm) there is a jump by only 2 orders of magnitude [1].

Our earalier SR diffraction studies have shown the existence of a lattice modiulation in $CaMn_7O_{12}$ at low tenmperatures below 250 K [2]. This modulation contributes to about 80 relatively weak satellite reflections which are observed at low temperatures and which disappear above 250 K. A quantitative model describing the atomic position modulations has been presented for $CaMn_7O_{12}$ [2]. The fact that this modulation disappears at the same temperature at which the dielectric constant starts to change motivated our present studies. The most important question is: Are these two phenomena related to each other or no ?

In this experiment we have measured high reoslution SR diffraction by using the beamline ID-31. Several $CaMn_7O_{12}$ samples with different grain sizes were investigated. Our measurements were perofrmed mainly at low temperatures down to 10 K by using the helium flow cryostat.

Low temperature behaviour

SR diffraction studies have been performed with two $CaMn_7O_{12}$ samples: one with relatievly large crystallytes and one with relatively small crystallites. The SR diffraction patterns of both samples were measured at several temperatures down to 10 K. Both samples show weak satellite peaks due to the lattice modulation at low temperature. Our studies have shown that the crystallite size has a weak influence on the lattice modulation. These results are however preliminary and qualitative. In order to obtain relaible conclusions one has to perform a detailed quantitative analysis of the modulation amplitude models as it was done in [2]. It is not clear at the present moment of the lattice modulations observed in both samples (with larger and smaller crystallites) van be described by using the same mathematical model.

References

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[2] W. Slawinski, R. Przeniosło, I. Sosnowska, M. Bieringer, I. Margiolaki and E. Suard, Acta Cryst. B65, 526 (2009).