MS25-O5 Study of charge and spin ordering, lattice distortion, and magnetoresistance in $SrFeO_{3-\delta}$

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Using resonant x-ray scattering, magnetization, and conductivity measurements, we report the correlation between the giant magnetoresistance and the charge and spin ordering in an iron-based oxide $SrFeO_{3-\delta}$. $SrFeO_3$ (SFO) has a cubic structure with an isotropic metallic behavior. The cubic perovskite $SrFeO_3$, in which iron is present as Fe^{4+}, exhibits the coexistence of metallic conductivity and screw-type antiferromagnetic ordering. However, the metallic state found in $SrFeO_3$ becomes unstable with respect to a charge disproportionation on Fe ions due to the oxygen deficient. In order to understand this oxidation effect on the magnetoresistance, crystals with different oxygen contents were grown by floating zone furnace. For this study, a crystal was characterized to have a δ~0.19 by transport measurements. From the conductivity and magnetization measurements, the crystal shows two unusual transport behavior at T~ 120 K and 65 K. By the means of resonant x-ray scattering, including soft and hard x-rays, the former is in accord with the formation of charge disproportionation distortion of Fe ions, and the latter is the helical magnetic structure. The coupling of the helical magnetic structure and the lattice distortion results in a complicated phase transition and a giant magnetoresistance at 65 K. A thermal hysteresis transition is also observed, and can be understood as the consequence of the non-equilibrium thermal transition of the domain-like charge modulations.

Keywords: resonant x-ray scattering, charge ordering, spin ordering, magnetoresistance

MS26. Modulated, modular and composite materials

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MS26-O1 Odd ones only - the systematic absences in Cu_3Sn and related structures

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The intermetallic compound Cu_3Sn has previously been described as a long-period antiphase boundary superstructure of the Cu_3Ti structure type. While the compound itself has been reported as a tenfold and an eightfold superstructure, ternary doped alloys show shorter repetitions. Interestingly, the diffraction patterns of these compounds show noncrystallographic absences that cannot be explained using the superstructure models. Since the compound exhibits phase broadening, these models are not satisfactory because the paucity of observed data does not allow for a refinement of the composition.

Here, an alternative, superspace model in the orthorhombic space group *Xmcm*(0β0)000 is proposed, with the centering vectors (0,0,0,0) and (1/2,0,0,1/2). The presence of the non-crystallographic absences is explained as a result of a dominating occupational modulation that is accompanied by a weaker displacive modulation. Within this context, the triangle wave was tested as an alternative to the square wave for the modelling of structures whose diffraction images show odd order satellites only while the intensity of the satellites is decreasing dramatically. Additionally, it is demonstrated how varying the length and the direction of the modulation wavevector in the superspace model can be used to produce the crystal structures of the ternary Cu_3Sn compounds and other colored hexagonal close packing (h.c.p.) structures.

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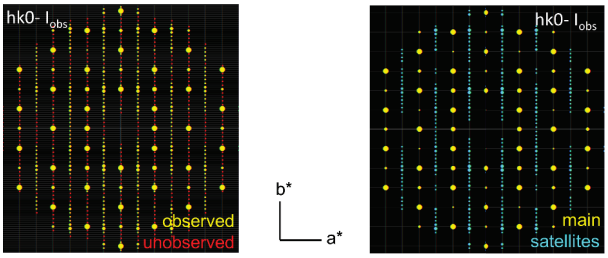

Figure 1. Treatment of the observed non-crystallographic absences in Cu_3Sn in a superstructure model in the 3D space group *Cmcm* (left) and in an alternative 3+1 D model in *Xmcm*(0β0)000.

Keywords: modulated structure, intermetallic compound