Crystal and Magnetic Structures of Sr_2FeMnO_{5+y}, y = 0.0 and 0.5.

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The defect perovskites Sr_2FeMnO_{5+y} with y = 0.0 and 0.5 were prepared by firing in either argon (y = 0.0) or air (y = 0.5). Both crystallize in cubic Pm-3m with long range disordered oxygen vacancies in contrast to the similar Ca_2FeMnO_{5+y} phases which show the vacancy ordered brownmillerite structure.[1] Neutron diffraction studies were carried out to verify the cubic structure, determine the oxygen content and detect magnetic scattering, if any. Table 1 shows the results with respect to crystal structure at 290 K.

Table 1. Unit cell constant and estimated y value for Sr_2FeMnO_{5+y} at 290 K.

y (nominal)	a_0 (Å)	y (measured)
0.0	3.8933(1)	0.00(1)
0.5	3.8308(1)	0.55(1)

From magnetic susceptibility data, neither material shows evidence for long range magnetic order (Figure 1).

Magnetic neutron scattering was detected for both samples. For y = 0.0 these could be indexed on the cubic cell with an ordering wave vector **k** = ½ ½ ½ , indicative of a G-type magnetic structure[2], but the reflections were broader than the resolution limit and corresponded to a correlation length of 50(1) Å (Figure 2).

For the y = 0.55(1) sample, one very much weaker magnetic reflection was observed which could also be indexed on the same magnetic cell, but with a peak width which is nearly resolution limited, see reference [1].

References

[1] Farshid Ramezanipour, John E. Greedan, Joan Siewenie, Th. Proffen, D.H. Ryan, Andrew P.Grosvenor and R. Donaberger, Inorganic Chem. 50 (2011) 7779-7791.

[2] Tetsuhiro Katsumata, Akihiro Takase, Yoshiyuki Inaguma, John E. Greedan, Jacques Barbier, Lachlan M. D. Cranswick and Mario Bieringer, MRS Symp. Proc. 988 (2007) 0988-QQ06-03.

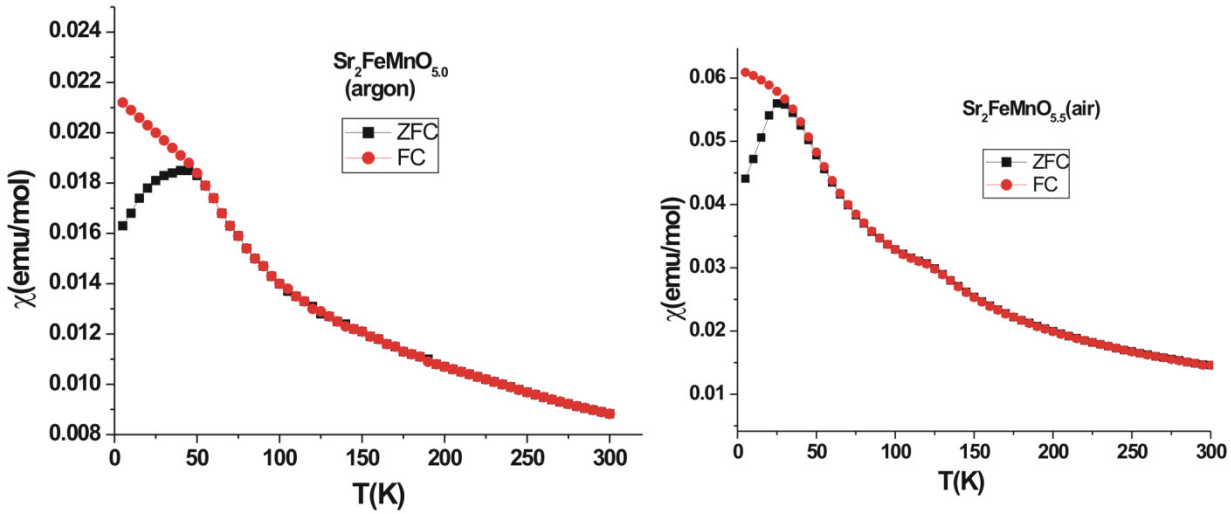

Fig. 1 Magnetic susceptibility for Sr_2FeMnO_{5+y}. (Left) y = 0.0. (Right) y = 0.5. Note the ZFC/FC divergences at ~ 55K and ~ 25K for y = 0.0 and 0.5, respectively.

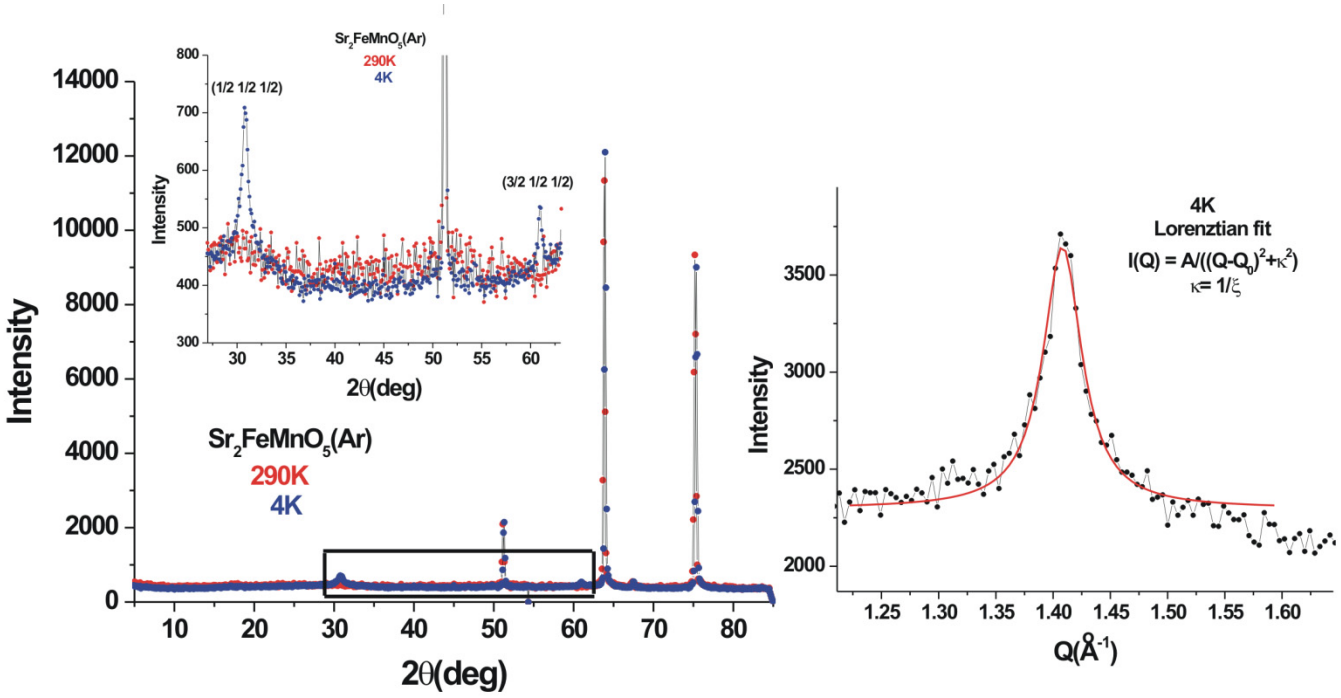

Fig. 2 (Left) Observation of diffuse magnetic reflections in $Sr_2FeMnO_{5.0}$ which can be indexed with **k** = ½ ½ ½ . (Right) Analysis of the correlation length giving a value of 50(1) Å.