**Poster**

# Investigation of structural correlations at dielectric and magnetic ordering in Cr/Fe doped α-$Mn_2O_3$

**M. Chandra[1], S. Yadav[2], R. Rawat[2] R J Choudhary[2], A K Sinha[3,4], K Singh[5]**

*[1]Institute of Physics of the Czech Academy of Sciences, Na Slovance 1999/2,18200 Prague 8, Czech Republic, [2]UGC-DAE Consortium for Scientific Research, University Campus, Khandwa Road Indore-452001, India. [3]HXAL, Synchrotrons Utilization Section, RRCAT, Indore 452013, India, [4]Department of Physics, School of Engineering, University of Petroleum and Energy Studies, Dehradun 248007, Uttarakhand, India, [5]Department of Physics, Dr B. R. Ambedkar National Institute of Technology, Jalandhar 144008, India*

*chandra@fzu.cz*

The samples α-$MnMn_{1-x}M_xO_3$ (X=0, 0.01; M=Cr and Fe) have been investigated for their temperature dependent structural, magnetic, and ferroelectric properties. Magnetically, the parent compound shows two antiferromagnetic transition one around 80 K and the other at 25 K [1,2]. Corresponding to the antiferromagnetic (AFM) ordering around 80 K, a clear frequency independent transition is observed in the dielectric permittivity. We showed that electric polarization emerges near AFM regime that can be modulated with magnetic field. To understand the structural correlation at the magnetic and electric ordering, we have performed temperature diffraction at Indian synchrotron. The temperature dependent diffraction pattern shows the splitting in peaks (800) and (811) at higher 2θ value near magnetic transition. The detailed structural analysis using synchrotron radiation X-ray diffraction demonstrates the increase in structural distortion with decreasing temperature, as well as changes in the unit cell parameters and bond lengths across the ferroelectric and magnetic ordering temperatures [2]. The Cr and Fe substitutions have significant effect on the magnetic and structural properties of Mn2O3. Like pristine Mn2O3, the Cr and Fe substituted samples also exhibit two AFM transitions: one at ~77 K, ~80 K, respectively and another at ~40 K. The temperature dependent SXRD results demonstrate the cubic to orthorhombic structural transition for the studied samples [3,4]. The pristine Mn2O3 shows cubic to orthorhombic transition around 310 K, whereas this structural transition shifted towards lower temperature side with these substitutions i.e. around 240 K for Cr and 260 K for Fe substituted samples. Interestingly, the centrosymmetric *Pcab* to non-centrosymmetric *Pca21* change in symmetry is also resolved at the ferroelectric ordering temperature for Cr substituted sample [4].

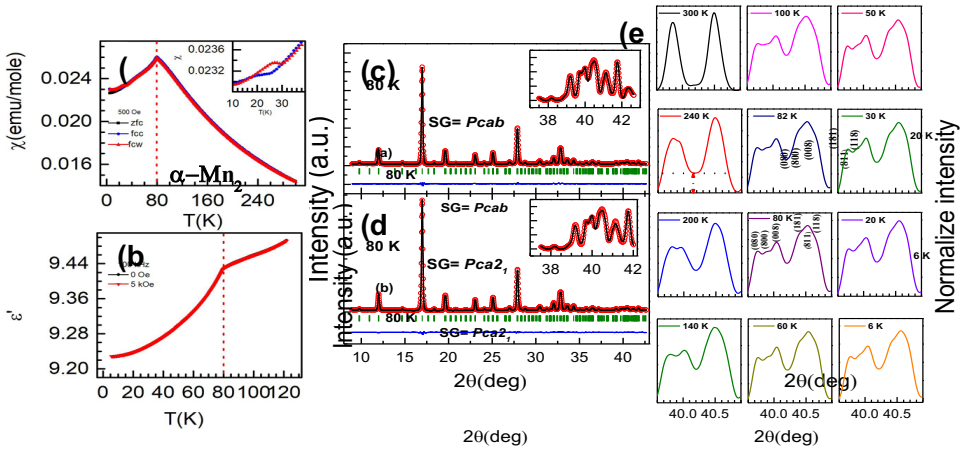


**Figure 1**. **(a)** Magnetic susceptibility (dc) vs temperature behavior at 500 Oe in different protocols; zero field cooled warming (zfc), field cooled cooling (fcc), and field cooled warming (fcw). The inset shows fcc and fcw curves near the 25 K transition. **(b)** Temperature variation of real part of dielectric permittivity at 100 kHz at selected magnetic fields (0 and 5 kOe) during warming **(c)& (d)** Rietveld refinement of SXRD patterns at 80 K **(e)** Normalized intensity of selected 2$\theta$ range to illustrate the splitting of {800} and {811} peaks at selected temperatures.

*[1] Geller, S., Grant, R. W., Cape, J. A. & Espinosa, G. P. (1967) J. Appl. Phys.* ***38****, 1457.*

*[2] Chandra, M., Yadav, S., Rawat, R., Choudhary, R.J., Sinha, A. K., Lepetit, M.B. & Singh, K. (2018) Phys. Rev. B* ***98****, 104427.*

*[3] Chandra, M., Yadav, S., Rawat, R., & Singh, K. (2020) J. Phys.: Condens. Matter.****32****, 29.*

*[4] Chandra, M., Yadav, S., Rawat, R., Choudhary, R.J., Sinha, A. K., Sagdeo, A., Singh, M.N. & Singh, K. (2023) J. Phys.: Condens. Matter.* ***36****, 095401.*