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Magnetic properties of nanostructured SnO_2-FeO milled samples

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Abstract -$(Sn,Fe)O_2$ samples were synthesized by mechanical alloying under Ar atmosphere. The powders present two magnetic phases at RT, a paramagnetic and an ordered one. The percentage of ordered phase is almost constant with the composition and may be correlated with oxygen vacancies in the samples. At low temperature a progressive blocking process is observed.

Since a theoretical prediction published in 2000 [1] oxide diluted magnetic semiconductors (O-MDS) became promissory candidates for potential technological applications like spintronics. The search of O-DMSs which present ferromagnetic behavior above room temperature is nowadays a very active research field. It is well known that the magnetic behavior is strongly dependent on the synthesis conditions of the samples. Part of our research is to explore the possibility to obtain ferromagnetism in nanostructured powder samples prepared by mechanical alloying from FeO and SnO_2 precursors. In this communication we present the X-ray diffraction and Mössbauer characterization of $Sn_{1-x}Fe_xO_2$ samples with x= 0.025, 0.05, 0.075 and 0.1. Appropriated concentrations of the precursors were mechanically milled during 10 h in argon atmosphere at 32 Hz. A 10 Fe at % sample milled in air was prepared for comparison purposes. Room temperature Mössbauer spectra for all argon milled samples reveal that a fraction of approximately 13 % Fe atoms are magnetically ordered while the remaining Fe atoms present paramagnetic behavior with 2+ and 3+ valence state. The amount of the magnetic ordered phase is independent of the iron concentration in the sample but its relative fraction decreases by half when the milling process is carried out in air (see Figure 1) indicating an active role of oxygen vacancies in the presence of the magnetic order. AC-susceptibility measurements (see Figure 2) show, for all samples, the occurrence of frequency dependent phenomena and indicate the presence of unblocked moments at RT.

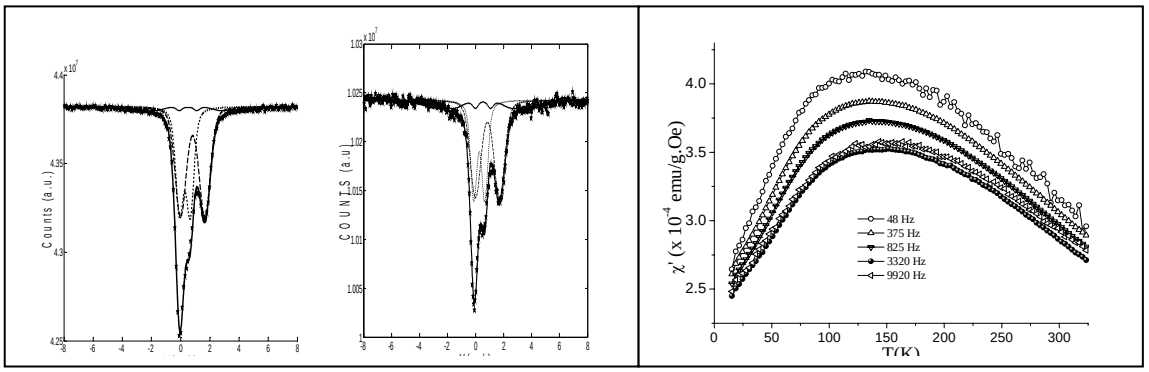

Figure 1: RT Mössbauer spectra of the x=0.1 samples milled in air (left) and argon (right)

Figure 2: AC -Susceptibility for the sample with x=0.05.

Reference

[1] Dietl T Science (2000) **287** 1019