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Evaluation of the Mn^{+2} concentrations in the structural and morphological characteristics of ZnO synthesized by the method of polymer precursors

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Abstract - This study aims to evaluate the concentration of dopant in the structural and morphological characteristics of $Zn_{(1-x)}$ Mn_xO (x=0.025 to 0.1 moles) powders synthesized by the Pechini method. The powder was characterized by: XRD, BET and SEM. The XRD analysis of the powders showed the formation of ZnO phase with typical structure of wurtzite, monophasic. The SEM analysis showed homogeneous particles with soft pellets. The particle size, calculated from BET was between 24 and 63 nm respectively, indicating that with the character of nanosized powders.

Zinc oxide is a semiconductor material of the group II-VI which has a "gap" of energy of around Eg = 3.2 eV, a large range of excitation energy and electrical conductivity controlled [(1)], and when doped with metals of transition exhibit the phenomenon ferromagnetic at room temperature[(2)]. The nanosized $Zn_{1-x}Mn_xO$, (x=0,025 to 0,1moles) was prepared by the polymeric precursor method. The analysis of X-ray diffraction patterns (Fig.1) revealed the presence of peaks characteristic of the ZnO phase, and a hexagonal structure typical of wurtzite. In the Table 1, we observed the results of particle size (D_{BET}), crystallite size (D_{DRX}) and lattice parameter (a=b, c). It can see that the crystallite sizes of all samples were nanometric and below 50 nm. The lattice parameters were constant. The particle sizes by BET were between 63 and 24nm. In Fig. 2, the SEM picture shows the presence of agglomerate soft and particles homogeneous. We can conclude that the Pechini method is an efficient method to produce powders with high purity.

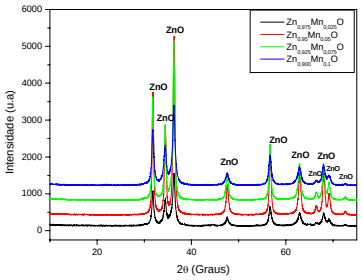

Figure 1- XRD of ZnO powders calcined at 500°C by 1h

Table 01: size particle, size of crystallites and the lattice parameters a, b and c for different dopagens on the basis of the calcination temperature of 500°C for 1 hour.

x	Calcined temperature 500°C			
	D_{BET} (nm)	D_{DRX} (nm)	**a=b** (Å)	**c**(Å)
0.025	63	23	3,2491	5,2057
0,05	49	20	3,2478	5,2086
0,075	37	14	-	-
0,1	24	21	-	-

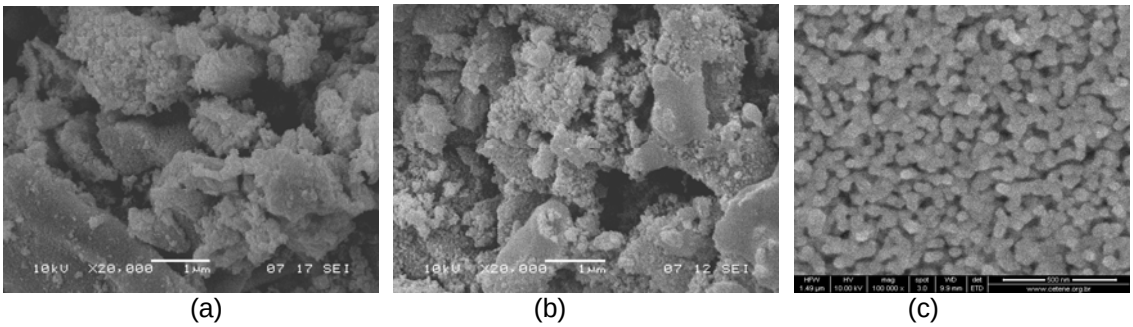

Figure 02: SEM of the powders of zinc oxide doped with manganese to different compositions, calcined at temperature of 500°C: (a) $Zn_{0,975}Mn_{0,025}O$; (b) $Zn_{0,95}Mn_{0,05}O$ e (c) $Zn_{0,925}Mn_{0,075}O$.

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