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SYNTHESIS AND STRUCTURAL CHARACTERIZATION OF Fe/Co/Mn-DOPED SnO2 NANOPARTICLES OBTAINED BY A PROTEIC SOL-GEL METHOD

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Tin dioxide (SnO_2) is a n-type semiconductor with a wide band gap (Eg= 3.6 eV, at 25º C) with good transparency and sensitivity to reducing gases. It finds a wide range of applications such as in gas sensors, optoelectronic devices, and dye-base solar cells. The cassiterite belongs to a rutile-type tetragonal system with a P4/*mnm* space group. In this work, nanostructured SnO_2 and $Sn_{1-x}M_xO_2$ (M = Fe, Co, Mn and x=0.02, 0.05 and 0.08) were synthesized by a proteic sol-gel method. X-ray absorption near-edge spectroscopy (XANES) measurements revealed that dopant ions are incorporated into the compounds as Fe^{3+}, Co^{2+}, and Mn^{2+}. X-ray powder diffraction (XRPD) patterns and Fourier transform infrared spectroscopy (FT-IR) analyses revealed that all compounds presented the tetragonal rutile structure expected for SnO_2, suggesting that Fe^{3+}, Co^{2+}, and Mn^{2+} were incorporated into the tin dioxide crystalline lattice. No impurity phases were detected by these techniques. Lattice parameters obtained by Rietveld refinement of XRPD patterns reinforces the finding that doping ions are incorporated into the crystalline matrix substituting Sn^{4+} ions. Average crystallite sizes calculated by Scherrer's equation are found to vary from 13 to 24 *nm*. Room temperature transmission Mössbauer spectroscopy (TMS) results on Fe-based compounds showed the existence of two Fe^{3+} paramagnetic doublets consistent with distorted octahedral sites. No Fe-based impurity phases were detected by TMS.