Fe-Doped SnO$_2$ Powders Obtained By Sol-Gel Method, Mechanochemical Alloying, and Thermal Treatment — JAIME OSORIO, ANA CALLE, JAILES BELTRAN, LUIS SANCHEZ, Universidad de Antioquia, LILIANA TIRADO, Universidad del Quindío, KIYOSHI NOMURA, University of Tokyo, CESAR BARRERO, Universidad de Antioquia, ESTADO SOLIDO TEAM, OPTOELECTRONICA TEAM, APPLIED CHEMISTRY SCHOOL OF ENGINEERING TEAM — The present work is aimed to investigate experimental conditions to obtain pure Sn$_{1-x}$Fe$_x$O$_{2-\delta}$ ($x$=0, 0.05, and 0.1) powders by three methods: (1) sol-gel method, (2) mechanochemical alloying and (3) thermal treatment. In (1), different precursors were employed: mixtures of Sn$^{4+}$ and Fe$^{3+}$ or Sn$^{2+}$ and Fe$^{2+}$. In (2), SnO$_2$ and α-Fe or α-Fe$_2$O$_3$ were used as reactants. In (3), the Fe-doped SnO$_2$ were obtained by mechanochemical milling and thermal treatment. All samples were characterized by X-Ray diffraction (XRD) using Rietveld refinement, Fourier-transformed infrared (FTIR) spectroscopy and room temperature $^{57}$Fe Mössbauer spectrometry (MS). The XRD patterns of samples prepared by (1) showed only peaks of SnO$_2$. The MS showed ferromagnetic and paramagnetic signals. The samples obtained by (2) showed XRD peaks due to SnO$_2$ (rutile). The MS revealed the presence of Fe$^{2+}$ and Fe$^{3+}$ states as well as α-Fe or α-Fe$_2$O$_3$ due to the reactants. In the case of (3) was observed total incorporation of Fe$^{3+}$ in the SnO$_2$ structure without presence of impurities.

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