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Fe Doped-ZnO Nanofibers Synthesized by Electrospinning.

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ZnO semiconductor, with a 3.37 eV band gap, has proven to be a useful and promising material for electronic and optical applications, specially, in the nanotechnology area. However, doped ZnO with transition metals offers more scientific and technological possibilities, such as diluted magnetic semiconductors or to modify its optical and electrical properties with metals as Al and Ga [1]. ZnO, in nanoscience, has been studied in many different ways, such as films, nanoparticles, nano-rods, nanotubes and recently nanofibers. ZnO nanofibers have showed an excellent surface/volume relation, flexibility, easy to produce, etc. The synthesis of Fe doped ZnO nanofibers has been accomplished by A. Baranowska-Korczyc et al [2]. They reported a method to synthesize it, using as precursors zinc acetate (C4H6O4Zn_2H2O, CHEMPUR) and iron acetate(CH3CO2)2Fe. In addition, they dissolved poly(vinylalcohol)(PVA) in distilled water. Both solutions were mixed and processed in an electrospinning equipment to perform the nanofiber synthesis. There are many techniques to produce nanofibers, but most authors agree that the electrospinning technique has shown to be easier, more versatile and more efficient than others.

In this report, Fe doped ZnO nanofibers synthesized by Electrospinning Technique, using an Electrospinning Equipment Nabond Unit_Standard, is described. The synthesis process required the preparation of a solution formed by the combination of two precursor, one of them containing zinc acetate (Zn (CH3COO)2·2H2O) and iron acetate(CH3CO2)2Fe (0.5M) in absolute ethanol. The other precursor solution was prepared with polyvinylpyrrolidone (PVP), water (30%) and absolute ethanol (70%). The solutions were mixed and stirred for 24 hours. A transparent and yellow substance was obtained, which was loaded in a syringe of 10 ml, connecting to the electrospinning equipment with a thin hose. A needle was placed at the end in the other extreme of the hose, at 15 cm from collecting surface. A 20 kV voltage was applied between the needle and the collector. A layer was formed by the polymeric fibers over the collector.

The ZnO nanofibers characterization was performed by High Resolution Transmission Electron Microscopy (HRTEM), Energy Dispersive Spectrometry (EDS), Scanning Electron Microscopy (SEM), X Ray Diffraction (XRD) and Thermo-Gravimetric Analysis (TGA) techniques.

In Fig. 1, it can be observed the SEM images, the precursor PVP fibers with an average diameter of around 300 nm. Fibers were heated in air in a furnace at 600 °C for 1 hour to eliminate the PVP layer and to synthesize the ZnO structure, in agreement with the TGA study. Next, the material was examined by the XRD technique and the result is illustrated in Fig. 2, showing that the produced material matches with ZnO Wurzite phase. However, two lines unexpected, belonging to Fe_2O_3 structure appeared. They are very small, but it is possible that a small excess of the iron acetate amount and the heat process

favored the growing of this phase. On the other hand, Fig. 3 exhibits HRTEM results, showing an example of nanofiber with an average diameter of 50 nm.

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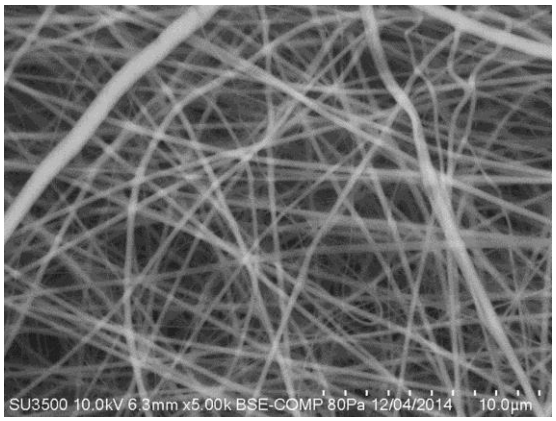

Fig. 1 SEM micrograph showing polymeric Fe doped ZnO nanofibers

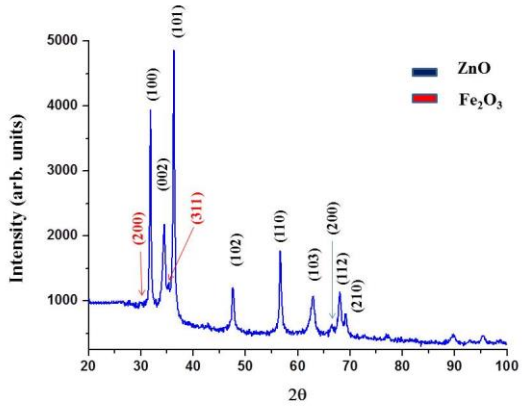

Fig. 2 XRD of the material showing Wurzite Structure and some lines of Fe_2O_3 phase

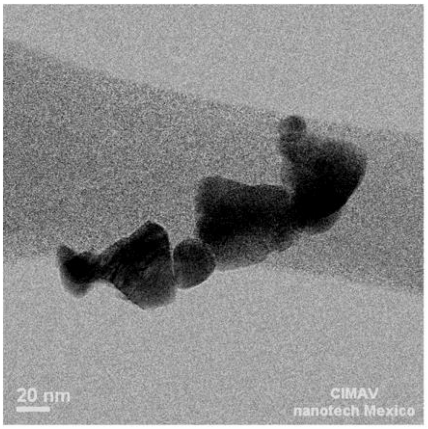

Fig. 3 HRTEM micrograph of Fe doped ZnO Nanofiber

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