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Fe-DOPING EFFECTS OF FERROMAGNETIC $Zn_{0.98-x}Fe_{0.02}Mg_xO$ SEMICONDUCTOR

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It is known that doping of different elements in ZnO leads to new interesting properties. Wide range solubility of Mg in the zinc blend structure was expected because the tetrahedral ionic radius of Mg^{2+} (0.57Å) is similar to that of Zn^{2+} (0.60Å). $Zn_{0.98-x}Fe_{0.02}Mg_xO$ (0.05, 0.1, 0.2) powders were prepared with the sintering at 1200 ℃ in Ar atmosphere. The structure, electric and magnetic properties for $Zn_{0.98-x}Fe_{0.02}Mg_xO$ (0.05, 0.1, 0.2) powders have been studied with x-ray diffraction, vibrating sample magnetometer, and Hall measurement. The x-ray diffraction patterns of the $Zn_{0.98-x}Fe_{0.02}Mg_xO$ (0.05, 0.1, 0.2) powders showed no detectable MgO peaks for $x \leq 0.1$, whereas clear MgO peaks as $x = 0.2$. All the peaks for the x-ray diffraction patterns of $x \leq 0.1$ samples belong to the hexagonal ($P\bar{6}m2$) lattice of ZnO. Both the *a*-axes and *c*-axes lengths reduced with the increase of Mg content up to $x = 0.1$. The lattice parameters for the $Zn_{0.88}Mg_{0.1}Fe_{0.02}O$ were $a_0 = 3.251$ Å and $c_0 = 5.194$ Å at room temperature. The temperature dependence of magnetization curve was measured from 30 to 300 K ranges. As the hysteresis curve at 77 K for the $Zn_{0.88}Mg_{0.1}Fe_{0.02}O$ was indicated with two phases of a paramagnetic and a feromagnetic to coexistence. The temperature dependence of magnetoresistance curve was shown semiconductor behavior under the room temperature.

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