ZnO DMS fabricated by hydrothermal method under high pulsed magnetic field

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Diluted magnetic semiconductors (DMS), which refer to semiconductors with nonmagnetic ions partially substituted by transition-metal(TM) elements, have attracted much attention due to their potential applications in spin electronics and magnetic devices[1-2]. ZnO is one of the most promising oxide semiconductors with a direct wide band gap of 3.37eV and a relatively large exciton binding energy at room temperature[3], and has been popularly selected as a host semiconductor for DMS studies. In our work, Cr-Ni co-doped ZnO nanoparticles were fabricated by a hydrothermal method assisted by a high pulsed magnetic field of 4 T. The most obvious effect of the magnetic field was observed from the magnetic properties of the prepared ZnO: (Cr, Ni) nanoparticles. The nanoparticles prepared with the pulsed magnetic field during the hydrothermal reaction showed much higher saturation magnetization and coercivity (Figure 1). Additionally, the morphology was changed from hexagonal tripods with no pulsed magnetic field to flower like nanostructures with the assistance of the pulsed magnetic field (Figure 2). With detailed characterization using XRD, TEM, XPS, and Raman spectroscopy, we will discuss the effect of pulsed magnetic field on the structural and magnetic properties of ZnO: (Cr, Ni) nanoparticles.

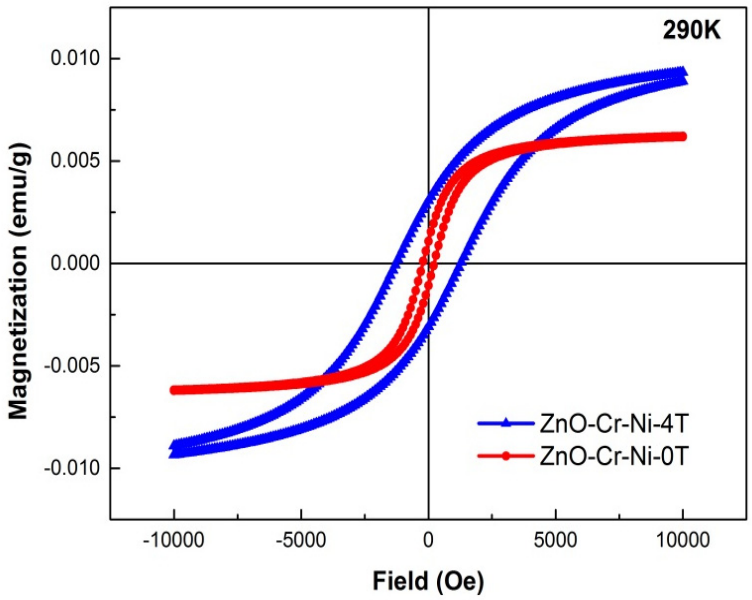

Fig. 1. M-H curves of Cr-Ni co-doped ZnO at 290 K:(up) Cr-Ni co-doped ZnO fabricated with 4T pulsed magnetic field ; (down) Cr-Ni co-doped ZnO fabricated with no magnetic field.

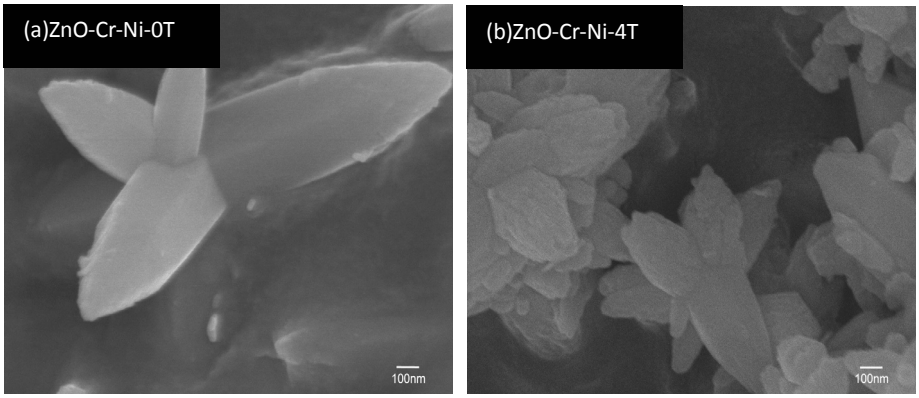

Fig. 2. SEM images of Cr-Ni co-doped ZnO samples: (a) Cr-Ni co-doped ZnO fabricated with no magnetic field and (b) Cr-Ni co-doped ZnO fabricated with 4T pulsed magnetic field

References

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