

## Abstract

This work has been focused on the study of structural and magnetic properties of ZnO-based diluted magnetic semiconductor (DMS) thin films. (0002) epitaxial  $\text{ZnCo}_{0.07}\text{O}$  films were prepared by ion beam deposition (IBD) system at room temperature. The existence of Co clusters in ZnCoO was excluded successfully by XPS and TEM analysis. Room-temperature ferromagnetism of ZnCoO was clearly observed from the results of SQUID measurements. Furthermore, with the introduction of NiO antiferromagnetic layer, we observed the hysteresis loop shifts in both horizontal and vertical directions after ZnCoO/NiO samples were field-cooled to low temperature. The directions of hysteresis loop shifts were strongly related to the cooling-field directions. Combine the experimental results of field-cooling strength effect and temperature effect, we can conclude that the hysteresis loop shifts in both horizontal and vertical directions of ZnCoO/NiO samples after the field-cooling process were induced by the so-called low temperature frozen spins in ZnCoO/NiO system. Meanwhile, from the two-step cooling process for ZnCoO/NiO samples, we can conclude that the FM/AFM exchange anisotropy in ZnCoO/NiO system was also set by the field-cooling process, which can only contribute to the hysteresis loop shift in horizontal direction.