Room temperature ferromagnetism of Zn1-xCoxO thin films on Al2O3 by RF magnetron sputtering technique

Chul-Hwan Choi and Seon-Hyo Kim
Department of Materials Science and Engineering, Pohang University of Science and Technology,
San 31 Hyoja-Dong, Pohang, Kyungbuk 790-784, Korea.

We report the synthesis of high-quality and room temperature ferromagnetic Co-doped ZnO(Zn1-xCoxO) thin films using RF magnetron sputtering technique on (0001) sapphire substrates. At least up to x=6.6wt%, the films have the single phase of the same wurtzite structure as pure ZnO, which was characterized by HR-XRD. SQUID magnetometer was used to characterize magnetic properties of Zn1-xCoxO films at 300K. It shows typical hysteresis curves indicating room temperature ferromagnetism and that susceptibility gradually increase as Co content increase. The possible existence of Co metal cluster or Co surrounded by oxygen in Zn1-xCoxO thin films could be excluded by the results of XPS analysis. Hall measurement was performed to define carrier type and concentration. All the samples are n-type characteristic and electron concentration varies from 6.39x10^{18} to 4.68x10^{19} according to Co content, which supports that room temperature ferromagnetism of Zn1-xCoxO thin films is electron mediated. FESEM and EDS were also used to investigate surface morphology and composition of Zn1-xCoxO thin films, respectively.