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Electric field control of magnetic semiconductor (Zn,Co)O HYEON-JUN LEE, ERIK HELGREN, FRANCES HELLMAN, Dept. of Physics, Univ. of California, Berkeley — The magnetic transport of a conducting Al(2%) doped (Zn,Co)O-field-effect transistor is investigated at low temperature (2-10 K). The Al doped (Zn,Co)O channeling layer ($\sim$ 26 nm-thick) was deposited by magnetron sputtering at 550oC and processed into a 40 μm thick Hall bar geometry by photolithography and wet etching. An 80nm-thick AlOx layer was deposited at room temperature as the insulating barrier and Cr/Au was used as electrodes. The Hall effect and sheet resistance were measured from 2 - 10 K as a function of temperature, magnetic field and gate electric field. For gate electric field E=0V/cm, the electron concentration is 2.58 x 1014/cm2 at 5 K and there is no anomalous Hall effect. This carrier concentration is experimentally shown (by the Hall effect) to be tuned by $\pm$ 7.0 x 1012/cm2 with E=$\pm$4MV/cm. Application of E=+4 MV/cm induces magnetism in the channel layer as seen by an anomalous Hall effect. These results show that the magnetic properties of (Zn,Co)O with Al-doping can be modulated by gate electric field at low temperature. This research was supported by both DOE and WIN.

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