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Gate tunable spin exchange interaction and inversion of magnetoresistance in ferromagnetic ZnO nanowire VIJAYAKUMAR MODEPALLI, MI-JIN JIN, JUNGMIN PARK, JUNHYEON JO, JI-HYUN KIM, JEONG MIN BAIK, Ulsan national institute of scence and technology, JEONGYONG KIM, Sungkyunkwan University, JUNG-WOO YOO, Ulsan national institute of scence and technology — Tuning magnetism in diluted magnetic semiconductor (DMS) is one of the central issue to the development of future spintronic device applications. Particularly, realizing such control in nanostructure has received growing attention. Here, we report the dramatic change of MR in ferromagnetic ZnO nanowire with varied gate voltages (+50 V to -40 V) at different temperatures (2 K to 50 K). The MR signal was greatly influenced by the gate voltage induced carrier concentrations which results the inversion of MR from positive to negative sign while pertaining the coexistence of both parts before inversion in the range of -2T to 2T. The origin of negative MR is mainly due to spin scattering while the positive one is due to a field induced change in relative populations of conduction bands with different conductivities. The extracted spin exchange related parameter was well tuned with the varied gate voltages at different temperatures. More importantly this type of gate tuning of spin exchange interactions in ferromagnetic single ZnO nanowire is well suitable for future spintronic device applications.

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