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Electrical Probing of Magnetic Phase Transition and Domain Wall Motion in Single-Crystalline Mn_5Ge_3 Nanowire[1] JIANSHI TANG, CHIU-YEN WANG, KANG L. WANG, Device Research Laboratory, Department of Electrical Engineering, University of California, Los Angeles, California, 90095, USA, LIH-JUANN CHEN, Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu, Taiwan, 30013, Republic of China — We studied the magnetic phase transition and domain wall motion in single-crystalline Mn_5Ge_3 nanowires fabricated by thermally germaniding Ge nanowires with Mn contacts. The R-T curve showed a clear slope change near 300 K accompanied by a magnetic phase transition from ferro- to para-magnetism. Near this phase transition, the critical behavior was characterized by a power-law relation with a critical exponent of about 0.07. Besides, a cusp revealed in the dR/dT curve at about 67 K was attributed to a possible magnetic transition between non-collinear and collinear ferromagnetic states. Furthermore, temperature-dependent magneto-transport measurements demonstrated a hysteretic, symmetric and stepwise axial magnetoresistance. The interesting features of abrupt jumps indicated the presence of multiple domain walls in the Mn_5Ge_3 nanowire and the annihilation of domain walls driven by the magnetic field. The fitting on the temperature-dependent depinning fields yielded an energy barrier of 0.166 eV based on the Kurkijarvi model describing the domain wall depinning as thermally assisted escape from a single energy barrier.

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