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Spin-dependent transport properties of a GaMnAs-based vertical spin metal-oxide- semiconductor field-effect transistor structure[1]
TOSHIKI KANAKI, HIROKATSU ASAHARA, SHINOBU OHYA, MASAAKI TANAKA, The University of Tokyo — Spin metal-oxide semiconductor field-effect transistors (spin MOSFETs) [1] are one of the most promising devices for the post-scaling era. In previous studies on spin MOSFETs[2,3], the drain-source current was controlled by the gate-source voltage and magnetization configuration of the source and drain; however, the magnetoresistance (MR) ratios (0.1% [2] and 0.005% [3]) were too small to be put into practical applications, and thus spin MOSFET with a high MR ratio is strongly required. Here, we study a GaMnAs-based vertical spin-MOSFET structure. We successfully modulate the drain-source current I_{DS} by ˜0.5 (–0.5) % with a gate-source voltage of –10.8 (+10.8) V and also modulate I_{DS} by up to 60 % with changing the magnetization configuration of the GaMnAs source/drain at 3.5 K. The MR ratio is more than two orders of magnitude higher than that obtained in the previous studies on spin MOSFETs[2,3][4] [1] S. Sugahara and M. Tanaka, APL 84, 2307 (2004). [2] R. Nakane *et al.*, JJAP 49, 113001 (2010). [3] T. Sasaki *et al.*, Phys. Rev. Appl. 2, 034005 (2014). [4] T. Kanaki *et al.*, submitted; arXiv:1510.07497.

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