Local Oersted Field Generation at the Junction between Ferromagnetic Nanowire and Electrode

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Control of magnetization states in magnetic nanostructures has drawn great attention due to the possibilities of various applications. For instance, memory architecture based on nanowire geometry, so-called the racetrack memory, has been recently proposed and extensively studied. In the racetrack memory, the information is stored in the magnetic domains, which are partitioned by the domain walls. The current-induced domain wall motion is then extensively investigated. In general, the current generates two major effects. One is the spin transfer torque (STT) effect, which has been the main issue in recent magnetism study. O. Boulle *et al.* revealed that the STT efficiency is about 2.5×10^{-10} Oe·m^2/A in $(Pt/Co)_3$/Pt nanowire. The other effect, called as the Oersted field generation, has been less studied. It is because the average magnetic field over the nanowire cross section is vanished due to the symmetry. However, at the junction of the electric contact, the symmetry is broken and considerable Oersted field has to be generated. In this study, we investigate the Oersted field generation at the junction of the electric contact. The local Oersted field is found to be locally concentrated at the junction, which is ascribed to the nonuniform current flux distribution. The magnitude of the local Oersted field is quantitatively examined.

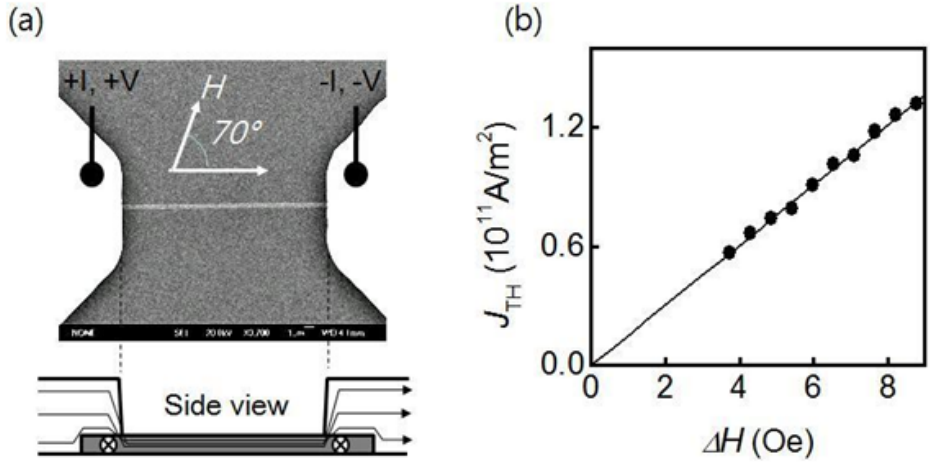

Figure 1 (a) SEM image of the Py nanowire structure with electrodes (upper image). Schematic diagram of the current path and local magnetic field generation (lower image). (b) Threshold current density in the nanowire with respect to ΔH.