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Study on the Current Driven Domain Wall Motion in $Ni_{81}Fe_{19}$ Nanowire

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The current driven motion of magnetic domain wall in $Ni_{81}Fe_{19}$ nanowire has been studied through electrical measurement of the anisotropic magnetoresistance (AMR). The critical current density (J_c) increases with the width of the nanowire, which is opposite to the behavior observed in nanowires with perpendicular magnetic anisotropy. These results are analyzed by micromagnetic simulations with different parameters of damping constant and nonadiabaticity. The obtained J_c behavior observed in experiments can be obtained in simulation only when the values of damping constant and nonadiabaticity are nearly equal. This implies that these two parameters, whose relation has always been in controversy, are indeed nearly equal in $Ni_{81}Fe_{19}$ nanowire. In addition to this, the interaction between two domain walls has been studied. After fixing a domain wall to a notch shaped defect, we drag another domain wall to the fixed domain wall with magnetic tip, measuring the annihilation point of the two domain walls. The minimum separation between the two domain walls is measured to be about 1 um, below which the two domain walls are annihilated due to their attractive interactions. This value actually represents the minimum bit separation in the so called racetrack style device made of $Ni_{81}Fe_{19}$ nanowire.