# Quantitative study of magnetoresistance in patterned $Ni_{80}Fe_{20}$ wires

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The interplay between the electric transport and the magnetism in nanostructure is an interesting research topic. Especially, the electric transport in magnetic domain wall has been studied for both theories and experiments. Even for the high crystalline anisotropic material, it's not easy to create a domain wall that is smaller than the Fermi wavelength of the metal. Recently, large magnetoresistance at room temperature was observed for a point contact between two Ni wires. These results can be attributed to the formation of domain walls at the contact. However, there is no clear evidence for the existence of the domain wall at the contact.

In this article, we used the zigzag geometry that confined the domain walls between two $Ni_{80}Fe_{20}$ wires. In addition, excess magnetoresistance at zero fields of different geometric wires were measured quantitatively. The wires were fabricated by e-beam lithography and lift-off process. The samples were named as z(x) (x=0, 1, 5, 10, 15, 20, 25). The number of x means the replacing zigzag unit in the straight $Ni_{80}Fe_{20}$ wire. The magnetoresistance (MR) was measured by PPMS with rotating angles between current and applied field and with varied temperature. Magnetic force microscopy (MFM) was used to observe the geometrical confinement of the domain wall directly. Figure1. shows the angular dependence on the resistance of different wires at zero field. We found excess resistance at 45-50° for z(x) (x=5-25). The excess resistance increased as the number of zigzag units increased. For sample z(25), the value of excess resistance is 10-7 ohm-cm. These results can be attributed to the formation of the domain wall at zigzag corners at zero field. Further direct evidence has been proved by MFM observation.

## References

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