Magnetoresistance of patterned $Ni_{80}Fe_{20}/Fe_3O_4$, $Ni_{80}Fe_{20}/\alpha$-Fe_2O_3 films

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The correlation between electric transport properties and magnetisms of patterned $Ni_{80}Fe_{20}$ wires have been studied extensively. The magnetization reversal process of $Ni_{80}Fe_{20}$ wires with different geometries have also been discussed widely. However, the influence of patterned Fe_3O_4, α-Fe_2O_3 films on the magnetoresistance (MR) of $Ni_{80}Fe_{20}$ wires still no be reported. The half-metallic magnetite Fe_3O_4 is a well known spinel ferrite. There has been a great interest in Fe_3O_4 due to it's highly spin polarized nature that is practical in the tunneling MR based device applications.

In this article, we discussed and compared the influence of the patterned Fe_3O_4, α-Fe_2O_3 films on the MR of $Ni_{80}Fe_{20}$ wires. The patterns were prepared by e-beam lithography and lift off process. The films were deposited by dc magnetron sputtering. Firstly, the patterned Fe_3O_4 or α-Fe_2O_3 films were deposited and then the $Ni_{80}Fe_{20}$ wires crossed the first patterns by second steps. The MR of $Ni_{80}Fe_{20}$ wires were measured by PPMS with different temperature. The magnetic domains were observed by magnetic force microscopy (MFM) with the real time applied field up to 1000 Oe. The spin structures of the patterned films were simulated by the software oommf with the mesh size of 10nm. The MR curve of patterned $Ni_{80}Fe_{20}/Fe_3O_4$ film has larger saturation field than $Ni_{80}Fe_{20}$ wire without patterned Fe_3O_4 as the field applied in the hard axis of the wire. The result was due to the interface coupling between two materials. The magnetic domain and spin structure can be observed by MFM images and simulated results, respectively

References

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