Influence of size on the perpendicular anisotropy of sub-micronic magnetic dots

Contact: Bernard RODMACQ DSM/INAC/SPINTEC bernard.rodmacq@cea.fr 438784356

PhD may follow: Yes

Summary :

The training course proposes a systematic study of the influence of the size of magnetic dots with perpendicular anisotropy on the field of reversal of magnetization by measurements of Kerr Effect magnetometry with focused beam making it possible to probe a single dot. One will study at the same time, according to the size of the dots, the variation of the average values and the width of distribution of the fields of reversal. One will be able to also vary the initial force of the perpendicular anisotropy (before engraving) by modifying the thickness of the magnetic layers.

One will also study the thermal variation of these fields of reversal by in-situ measurements at various temperatures.

Full description :

One of the fields of activity of the Laboratory Spintec (CEA/CNRS) relates to magnetic materials with perpendicular magnetization, and their use in devices such as tunnel junctions for the realization of magnetic storage media. Information is coded by the relative direction of magnetizations of the two magnetic layers on both sides of the insulating barrier. The associated resistance variation allows their use as non-volatile magnetic element, associating a low resistance to a bit `0 ' and a high resistance to a bit `1 '. The advantage of structures with perpendicular magnetization compared to theose with planar magnetization is a greater compactness and a greater facility of writing information.

Nevertheless, for sub-micrometric sized dots, the writing of information (i.e the possibility of switching magnetization of one of the two layers compared to the other) becomes more difficult when the size of the dot decreases, because of the increasingly large influence of the trapping of magnetization by the defects in edges of dots.

The training course proposes a systematic study of the influence of the size of the dots on the field of reversal of magnetization by measurements of Kerr Effect magnetometry with focused beam making it possible to probe a single dot. One will study at the same time, according to the size of the dots, the variation of the average values and the width of distribution of the fields of reversal. One will be able to also vary the initial force of the perpendicular anisotropy (before engraving) by modifying the thickness of the magnetic layers.

One will also study the thermal variation of these fields of reversal by in-situ measurements at various temperatures.

This training course will make the candidate familiar with techniques of preparation of thin layers (cathode sputtering), lithography-engraving process and magnetic measurement techniques (Kerr Effect, Magnetic Force Microscopy).

Requested skills :

Interest for experimental science