

## Master Thesis/Diploma Thesis (from Oktober 2011)

### Real time detection of $\mu\text{m}$ -sized magnetic labels with microstructured GMR sensors

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Hard disk drive, Seagate

#### Background:

Since the discovery of the GMR effect by Peter Grünberg and Albert Fert in the late 80's the effect has found a broad field of commercial applications like as read heads for hard disk drives or for the automotive area. In the last decade the idea of using such GMR sensors for detection of biomolecules has come up in the scientific community. A high degree of integration makes so-called "lab-on-chip" devices possible, where different kinds of biomolecules can be detected in a biofunctionalized sensor array.

#### Description of Work:

The main task of this work is to systematically investigate microstructured GMR sensors for detecting and locally manipulating particles in the few  $\mu\text{m}$  regime. The thesis should therefore focus on the development of a scheme of detection of the magnetic labels. Therefore a controlled manipulation on the  $\mu\text{m}$  scale with magnetic fields generated by controlling lines (see figure 1) shall be investigated. In addition micromagnetic simulations shall be performed in order to model the sensor response to the presence of particles.

Besides the practical application of electrical measurement techniques (Four-point, Lock-In amplifier) the student will get an insight into the fundamentals of magnetic sensor concepts and their micromagnetic modelling.

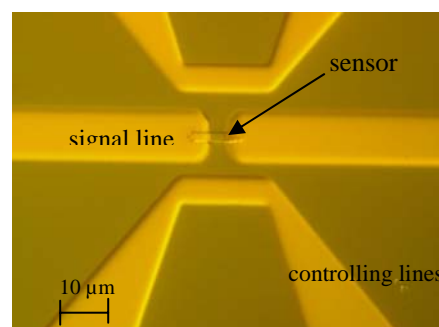


Figure 1: Microstructured GMR sensor

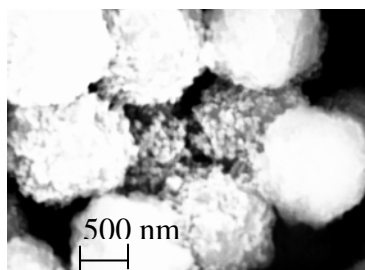


Figure 2:  $\text{Fe}_3\text{O}_4$  particles embedded in a polymer matrix

#### Requirements:

Besides the fundamentals in electrical engineering there is no special knowledge necessary. For the micromagnetic simulation as well as for the implementation of the measurement routine some programming experience might be helpful.

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