MicroNano Systems
BTU Cottbus

Faculty 1
Chair Micro- and Nano Systems

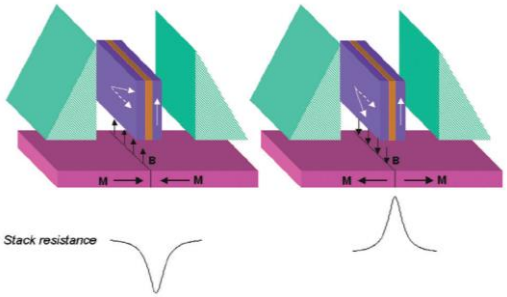
Prof. Dr. Harald Schenk

Brandenburgische Technische Universität Cottbus - Senftenberg

Advanced Micro Systems: Micro Sensors

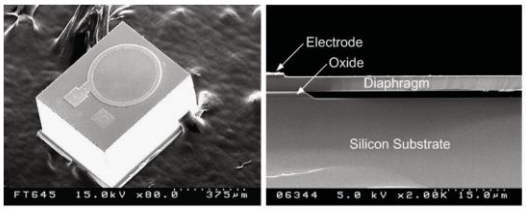
Modul 13752 (Lecture and Exercise)

The knowledge gained from the lecture Micro Systems (module number 13019) is extended and deepened in this module with regard to the **physical principles, fabrication and typical applications of modern and complex microsensors**.



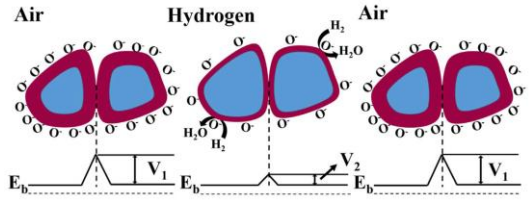
Giant Magnetoresistance (GMR): Schematic of the read back process in a hard disc drive as the medium with a recorded transition passes over a spin valve read element.

In the **first part of the lecture, the signal transfer** from the physical or chemical quantity to be measured (input) via the sensor-inherent signal transduction into an output variable (output) is considered in general. Then, in the **second part, the most important physical and chemical effects** used in today's microsensors are described and discussed. These include various magnetoresistive effects, magnetostriction, piezostriction, piezoelectricity, electromagnetic induction, thermoresistivity, thermoelectricity, pyroelectricity, physisorption and chemisorption.



Left: Scanning Electron Micrograph (SEM) image of a capacitive pressure sensor. Right: SEM of the cross section revealing the thin diaphragm and the electrode gap forming the pressure dependent capacitance.

In **the third part, the main characteristics of sensors** such as sensitivity, precision and accuracy, offset, linearity and response time are introduced. Finally, the **design, operation and limitations of selected modern microsensors** are presented and discussed in detail. Several specific application examples are introduced in form of case studies. The range of sensors and applications include infrared sensors for imaging, temperature measurements and gas sensing, pressure sensors e.g. for medical and barometric applications, highly miniaturized microphones used e.g. for active noise cancellation and hydrogen sensors.



Grain boundary barrier model of a polycrystalline ZnO hydrogen sensor.

In the **exercises**, what has been learned is repeated, reinforced and applied to solve concrete tasks in micro sensor technology and its applications.