

IIT Bombay is organising an Institute Lecture on Monday, December 6, 2010. The details are as follows:



Speaker : **Dr. Hubert Brückl**  
AIT Austrian Institute of Technology  
Nano Systems, Vienna  
Austria

Title : **Nanotechnology Boosts Sensor  
Technology**

Day & Date : Monday, December 6, 2010

Time : 5.10 p.m.

Venue : P.C. Saxena Auditorium

*All are invited.*

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**Abstract:**

Nanoscience and -technology provide a rich store for the development of novel sensors and devices. Nanosensors and nanodevices feature superior properties like higher sensitivity, fast response time, and low power consumption. Selectivity can be tailored by chemical functionalization. After long-year worldwide basic research, it is our conviction that the fruit ‘nanotechnology’ is ripe to be harvested, and to be implemented in novel and superior products. In order to pave the way for nanodevices it is necessary to combine standard microelectronics with “exotic” materials. The heterogeneous integration of bio-, nano- and biomimetic interfaces and materials is the key to this paradigm change. This contribution will contain a few examples towards this development.

Recent progress in fabrication and characterization of magnetic nanoobjects like rods and beads has triggered many ideas and possible applications in the biomedical field. A magnetic biochip using the combination of both magnetic nanoobjects as markers and magnetoresistive sensors has proven to be

competitive to standard fluorescent DNA-detection at low concentrations. Superparamagnetic nanoparticles are detected via giant magnetoresistance (GMR) or tunnel magnetoresistance (TMR) sensors. Their size ranges from a few nm up to few 100nm and can be reliably reproduced by physical or chemical processes.

Magnetic nanoobjects additionally provide the unique possibility to actively manipulate biomolecules, on-chip, which paves the way to an integrated 'magnetic lab-on-a-chip' combining detection and manipulation. Manipulation can be accomplished either by an external magnetic field or on-chip via currents running through specially designed line patterns on a chip platform. It can be shown that hybridization processes can be accelerated compared to usual thermal activation. A prototype is under development for Sepsis diagnosis. The ultimate goal is the detection of antibodies at the picomolar level at shortest reaction times.

Crickets, and other orthopteroidea, possess one of the most sensitive hair-based sensory systems found in nature [1]. Tiny hairs on the backward Cerci feel slightest air movements of only 0.1 m/hour velocity. We try to mimic this concept in an artificial sensor combining nanowires and magnetic detection. The intention of the collaborative project is to integrate self-assembled nanowires containing magnetic components in thin film sensors exhibiting giant magnetoresistive (GMR) effects. Any movement of the nanowires is translated to the adherent magnetic components and can be detected via their stray fields by the adjacent GMR stack. The proposed nanosensor is very simple, and hence low-cost and competitive.

Further examples of nanosensors and heterogeneous integration are (a) gas sensor consisting of nanowires, (b) infrared imaging sensor arrays utilizing metamaterials to be wavelength selective, and (c) third generation solar cells made from nanowires and nanoparticles.

[1] W. Gnatzy, in "Information processing in animals", Vol. 10, ed. M. Lindauer, pp. 1-92 (1996)