



Workshop: Magnetic Sensing & Spintronics 30.3.2022 14.00 Online

Within Fachtagung

„Mikroelektronik-Forschung in Deutschland: von den Grundlagen zur Anwendung“

Magneto-resistive effects are already widely exploited in magnetic sensors and in magnetic memories. New developments exploit the spin orbit effects in heavy metals and at interfaces between materials to manipulate or sense the magnetic state with the aim to either enhance the sensitivity or endurance or to induce new functionalities as reconfigurable logic functions. The workshop aims to bring together experts from industry and research institutes and to show exemplarily the importance of this field for the microelectronics in Germany.

Venue: Online Via WebEx

Wolfgang Raberg, Infineon, Munich 14.00 - 14.45

Development of magnetoresistive sensors: Typical challenges and how research institutes can help to address them

Andreas Kehlberger, Sensitec, Mainz 14.45 – 15.15

From development to application, life cycle of a TMR Sensor

Patrick Matthes, Fraunhofer ENAS, Chemnitz 15.15 – 15.37

XMR based magnetic field sensors: from basic science to sensor systems for automotive application

Günter Reiss, University of Bielefeld 15.38 – 16.00

Superparamagnetism in magnetic tunnel junctions

Participation is free of charge

Registration required at: <https://ssl.vdivde-it.de/registration/3013>

will give access to all events of the Fachtagung

Questions regarding workshop:

Gerhard Jakob: jakob@uni-mainz.de

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Maßgeschneiderte
magnetische Sensoren

Abstracts

Wolfgang Raberg, Infineon, Munich

Development of magnetoresistive sensors: Typical challenges and how research institutes can help to address them

As the world's leading supplier of automotive semiconductors Infineon is also active in the field of magnetic sensors. While Hall based sensors are still dominant in many applications, magnetoresistive sensor technologies play an increasingly important role with Infineon having delivered several hundred million automotive qualified magnetoresistive sensors to customers so far. They also represent a rather dynamic field with new materials and concepts appearing regularly. This poses challenges for the development of new sensor concepts since a careful selection of candidate technologies has to be done in order to align fast innovation with the extensive quality investigations that ensure zero defect performance. In this talk some of these challenges will be presented and the possible role of research institutes is described in examples.

Andreas Kehlberger, Sensitec, Mainz

From development to application, life cycle of a TMR Sensor

Magnetic sensors have various application fields due to their strength of a contactless, robust, and fast measurement and low cost. Since years the market is dominated by Hall effect and AMR based technologies, making a successful placement of a novel technology like TMR based sensors challenging. In this talk we give an insight in the development of TMR sensors and their successful placement in the market, paving the path for a next generation of sensors.

Günter Reiss, University of Bielefeld

Superparamagnetism in magnetic tunnel junctions

Thin electrodes of magnetic tunnel junctions are key components for sensors and memories. They, however, can show superparamagnetism at surprisingly high temperature. We analyzed their thermally induced switching for varying temperature, magnetic and electric field. Although the dwell times follow an Arrhenius law, they are too small compared to a model of single domain switching due to entropic effects. Comparing data for varying barrier thickness allows to separate the impact of Zeman energy, spin-transfer-torque and voltage induced anisotropy change on the dwell times. Based on these results, we demonstrate a tuning of the switching rates by combining magnetic and electric fields, which opens a path for an additional application in noisy neural networks.

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Abstracts

Patrick Matthes,
Fraunhofer-Institute for Electronic Nano Systems (ENAS), Chemnitz
XMR based magnetic field sensors: from basic science to sensor systems for automotive application

Magnetic field sensors based on spintronic effects, especially the GMR (giant magnetoresistance) and the TMR (tunneling magnetoresistance) effect (both referred to XMR), play an increasingly greater role in industrial applications or the automotive sector [1]. Compared to the previously dominant Hall technology, they offer significant advantages in terms of sensitivity, power consumption, data acquisition rate *etc.* On the other hand, due to the ferromagnetic materials contained in XMR sensors, the hysteresis, mainly the limited magnetic field range due to the saturation of the magnetization, is a hurdle for various applications. In practice, the magnetic measuring range is usually limited to a few millitesla, with corresponding effects on parameters derived therefrom, such as, for example, distances and angles or the electrical current strength in a sensor application. In addition, for a particularly sensitive sensor intended to detect smallest signal strengths, disturbances from the environment (first of all the earth's magnetic field) are often the actual challenge for the sensor system development.

The Fraunhofer ENAS has clean room capabilities for sensor preparation on up to 200 mm wafer diameter, including various deposition and patterning techniques, as well as lithography at critical dimensions as small as 20 nm. In the field of XMR sensors, we scientifically contribute to the topics laser annealing as well as thin film crystallization, both of which being important for the magnetic and magnetoresistive properties of the prepared sensor elements. In addition to the latest results from these areas, the presentation further covers application related activities, where the focus is on the system design incl. sensor selection, integration and packaging, being supported by magnetic stray field simulations.

Literature

1. Yole Développement, Report “Magnetic Sensor Market and Technologies” (2017)
2. https://www.enas.fraunhofer.de/en/business_units/micro_and_nanoelectronics/Processes_and_technologies_for_micro_and_nanoelectronics/Technologies_for_Spintronics.html

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Maßgeschneiderte
magnetische Sensoren

Registration Info in English

Registration is cost free but required. Registered participants will receive the WebEx meeting link (Info on WebEx login see: <https://help.webex.com/en-us/article/nrbgeodb/Join-a-Webex-Meeting>)

Unfortunately the registration page at

<https://ssl.vdivde-it.de/registration/3013>

is in German only, while our workshop will be in English. You need to register for the two day “Abschlussmeeting” of the ForLab initiative, but you are free then to only join our workshop!

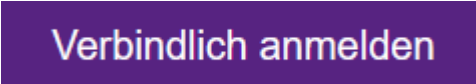
Here some information from the registration page:

- Deadline for registration: 24.3.
- After registration you will receive a registration confirmation via email within a few days.
 - “Akronym des geförderten Vorhabens” leave empty if not from Mainz or Bielefeld, else MagSens
 - Select Magnetic Sensing workshop for day two (On day one choose ‘Keine Teilnahme’ or a different workshop of your choice

Tag 2: An welchem der Workshops möchten Sie teilnehmen? *

14:00 bis 16:00 Uhr - Workshops der Forschungslabore Mikroelektronik Deutschland (ForLab) (in Parallelsessions)

Workshop 1 - Magnetic Sensing & Spintronics

- On “Datenspeicherung/Stornogebühren” you must chose yes=Ja to participate and this implies that you agree to be contacted by email or phone and that your name will be visible to other participants of the online conference, as there is no fee there will not be a cancellation fee
- On “Einverständniserklärung Teilnahmeliste“ You can select yes or no depending on whether you want to have your name, title, and organization on a participation list that will be mailed to all participants for the purpose of networking
- The button  will submit your registration!

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