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Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Tuesday, 04 June 2024, 9:00 s.t., TUDa, in Person and via Zoom

Prof. Dr. Jeffrey McCord

Nanoscale Magnetic Materials,

Kiel University

@TU Darmstadt L2|01 77
and via Zoom
Meeting-ID: 616 6297 8649
Kenncode: 694633

Magnetic domain engineering for low noise picotesla field sensors

Abstract:

Magnetic field sensors are particularly relevant for applications in IoT, smartphones, energy, and biomedical engineering. In this context, dedicated research is being conducted on novel thin-film composite magnetoelectric sensor concepts for the detection of magnetic fields down to the pT range. Wide-field magneto-optical Kerr effect microscopy with high temporal resolution is used to study local effects in operating composite sensor structures, supported by magnetic and electrical characterization. The analysis of working devices sheds light on magnetization changes and corresponding noise mechanisms due to domain nucleation, domain wall resonances, domain wall modes, and spin-wave-like phenomena for the various sensor types. By understanding the complex magnetic interactions, strategies and implementations are identified to optimize magnetic sensor structures in terms of reducing hysteretic contributions. The design and application of magnetic domain engineered magnetic multilayer structures with minimal noise are discussed in detail. With the current approaches and beyond magnetic domain activity, we are now seeing novel effects based on non-linear magnetoelastic effects and are approaching fundamental sensor limits.

About the speaker:

Jeffrey McCord is Professor in the Department of Materials Science at the University of Kiel. He obtained his Ph.D. for work on magnetic thin films. From 1997 to 2001, he worked at the IBM Storage Division in San Jose, developing magnetic recording heads. From 2002 to 2009 he was a research scientist and group leader at the IFW Dresden, until he accepted a position as head of the Nanomagnetism Department at the Helmholtz-Zentrum Dresden-Rossendorf. He is co-founder and was managing director of evico magnetics GmbH. In 2011, he joined the Kiel University as a Heisenberg Professor of Materials Science. His main research interests are related to magnetic domains and magnetic materials. The research topics range from fundamental research to engineering materials and devices, with a focus on magnetization dynamics, exchange bias, magnetic thin films and nanomagnetism.