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das Institut für Chemie und das Institut für Physik

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GESELLSCHAFT DEUTSCHER CHEMIKER

Vortrag

von Herrn

Prof. Arno Ehresmann

Institute of Physics and Center for Interdisciplinary Nanostructures Science and Technology (*CINSaT*)

University of Kassel

“Fundamentals and Applications of (Light) Ion-Bombardment-Induced Anisotropy Engineering in Magnetic Thin Film Systems”

am: **Donnerstag, 19.06.2025**

um: 16:00 Uhr

wo: im Raum **A12.232**

Gäste sind herzlich willkommen!

TECHNISCHE UNIVERSITÄT
IN DER KULTURHAUPTSTADT EUROPAS
CHEMNITZ

Prof. Dr. Karin Leistner, Tel.: 0371/ 531 36963 (Chemie) und Prof. Dr. Olav Hellwig, Tel.: 0371 531-30521 (Physik)

Prof. Dr. Michael Sommer - Telefon: 0371 / 531 32507
E-Mail: michael.sommer@chemie.tu-chemnitz.de

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GDCh Gesellschaft Deutscher Chemiker

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Fundamentals and Applications of (Light) Ion-Bombardment-Induced Anisotropy Engineering in Magnetic Thin Film Systems

(Light) Ion-bombardment-induced magnetic patterning (IBMP) of magnetic thin film systems enables the engineering of defined magnetic domain patterns. With IBMP it is possible to engineer the geometrical shape, the anisotropy in direction and magnitude, and the saturation magnetizations of the domains. Fig. 1 shows the main fabrication steps to create engineered in-plane domains in Exchange-Bias thin film systems. The potential of this unique nanotechnology is huge and spreads from sensing applications to unique experimental approaches investigating spin transport and magnonics. In the first part of this presentation fundamentals of IBMP will be shown with some examples of its application to fabricate angle- and magnetic field sensors.
In the second part of the talk a strategy will be shown of how magnetic field landscapes emerging from these engineered remanent domains can be used for a fast magnetic particle transport in a quiescent liquid. The developed transport concept intrinsically suppresses agglomeration of the particles during their motion [1-4]. As ferromagnetic and superparamagnetic micro- and nano-particles are key components for lab-on-chip or micro-total analysis devices in biotechnology this concept paves the way for a sensitive analyte detection in home- or point-of-care applications without the necessity of PCR amplification.

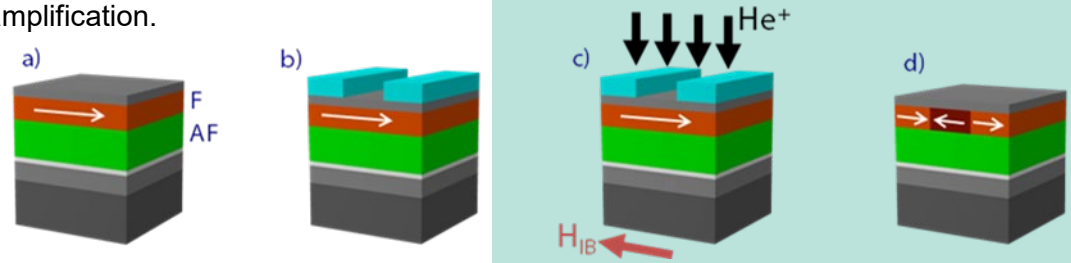

FIGURE 1. Essential steps to fabricate magnetically patterned Exchange-Bias layer systems: a) Exchange-Bias layer system consisting of a ferro- (F) and an antiferromagnet (AF) with initialized unidirectional anisotropy (arrow). b) Lithography mask to define the geometrical shape of the engineered domains. c) keV-He-ion bombardment in an external in-plane magnetic field to define the remanent magnetization direction in the bombarded areas. d) Removal of the resist mask with resulting domains.

References:

[1] A. Ehresmann, I. Koch, D. Holzinger, Sensors **15**, 28854 (2015)
[2] D. Holzinger, I. Koch, S. Burgard, A. Ehresmann, ACS Nano **9**, 7323 (2015)
[3] D. Holzinger, D. Lengemann, F. Göllner, D. Engel, A. Ehresmann, Appl. Phys. Lett **100,** 153504 (2012)
[4] T. Ueltzhöffer, R. Streubel, I: Koch, D. Holzinger, D. Makarov, O.G. Schmidt, A. Ehresmann, ACS Nano 1**0,** 8491 (2016)

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Prof. Dr. Michael Sommer
Telefon: 0371 / 531 32507
E-Mail: michael.sommer@chemie.tu-chemnitz.de