The 2020 Around-the-Clock Around-the-Globe Magnetics Conference: Invited speakers information

Name: Anna
Surname: Semisalova
Affiliation: University of Duisburg-Essen, Faculty of Physics & CENIDE, AG Farle
Country: Germany

Title of the talk: **Laterally patterned magnetic landscapes in $Fe_{60}Al_{40}$**

Biography:
Anna Semisalova is a lecturer at the Faculty of Physics, University of Duisburg-Essen (UDE) since March 2019. She obtained her PhD in Physics from Lomonosov Moscow State University (MSU) in 2012 in the topic of dilute magnetic semiconductors. After a postdoc and a following assistant professorship (since 2013) at Lomonosov MSU in nanomagnetism and smart magnetic materials, she spent 4 years as a postdoctoral research fellow at the Institute of Ion Beam Physics and Materials Research, Helmholtz-Zentrum Dresden – Rossendorf (2015-2019) where she joined a team working on research of the disorder-induced ferromagnetism in B2 materials ($Fe_{60}Al_{40}$, $Fe_{50}Rh_{50}$). Current scientific activities in UDE are focused on magnetization dynamics in thin films and nanostructures, including laterally patterned magnetic landscapes produced by ion irradiation. She co-authored 2 patents and a book chapter (Springer Series in Materials Science).
Contact: anna.semisalova@uni-due.de

Abstract:
Correlation between the ordered/disordered chemical structure and magnetism in several B2 alloys (e.g., $Fe_{60}Al_{40}$ and equiatomic FeRh) has stimulated significant efforts of researchers working in nanomagnetism, spintronics and materials science [1, 2, 3, 4]. These binary transition metal alloys allow a delicate tuning of magnetic properties in magnetic bilayers and laterally patterned nanostructures using structural disordering via ion bombardment. The magnetization of $Fe_{60}Al_{40}$ (FeAl) is highly sensitive to the transition from the B2-ordered structure to the A2 (bcc, or disordered) one [4,5,6]. The paramagnetic (PM) FeAl alloy can be turned at room temperature into a ferromagnet (FM) with a saturation magnetization of up to 800 kA/m when the structural disorder is introduced by ion irradiation with Ne ions [1]. Disordering of the structure is accompanied by a lattice expansion. Ion beam irradiation through lithographically produced masks allows for magnetic patterning of periodical disorder-induced nanostructures embedded in non-ferromagnetic structurally ordered FeAl surrounding, in other words the design of *magnetic landscapes*. Similarly, this technique can be used to produce individual embedded nanomagnets [7] in a paramagnetic surrounding. In this talk, recent examples of ferromagnetic nanostructures and magnetic landscapes in FeAl will be given. Magnetization dynamics and

ferromagnetic resonance in periodical ferromagnetic nanostructures with vertical interfaces between patterned FM and PM regions will be discussed with the focus on vertical and lateral spin-pumping effects in thin films.

References:

[1] R. Bali, S. Wintz, F. Meutzner et al., “Printing nearly-discrete magnetic patterns using chemical disorder induced ferromagnetism”, Nano Lett., vol. 14, no. 2, pp. 435–441, 2014.
[2] J. Ehrler, M. He, M.V. Shugaev et al., “Laser-Rewriteable Ferromagnetism at Thin-Film Surfaces”, ACS Appl. Mater. Interfaces, vol. 10, no. 17, pp. 15232–15239, 2018.
[3] M. Krupinski, R. Bali, D. Mitin et al., “Ion induced ferromagnetism combined with self-assembly for large area magnetic modulation of thin films”, Nanoscale, vol. 11, pp. 8930–8939, 2019.
[4] J. Ehrler, B. Sanyal, J. Grenzer et al., “Magneto-structural correlations in a systematically disordered B2 lattice”, New. J. Phys., vol. 22, 073004, 2020.
[5] J. Nogués, E. Apiñaniz, J. Sort et al., “Volume expansion contribution to the magnetism of atomically disordered intermetallic alloys”, Phys. Rev. B, vol. 74, no. 2, pp. 024407(5), 2006.
[6] E. Menéndez, M.O. Liedke, J. Fassbender et al., “Direct magnetic patterning due to the generation of ferromagnetism by selective ion irradiation of paramagnetic FeAl alloys”, Small, vol. 5, no. 2, pp. 229–234, 2009.
[7] M. Nord, A. Semisalova, A. Kákay et al., “Strain Anisotropy and Magnetic Domains in Embedded Nanomagnets”, Small, vol. 15, no 52, 1904738, 2019.