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Fyzikální ústav Akademie věd České republiky
Institute of Physics of the Czech Academy of Sciences

CELOÚSTAVNÍ SEMINÁŘ
FZU COLLOQUIUM

8. 9. 2023 | 10:00

Přednáškový sál SOLID21 | Lecture hall SOLID21
Na Slovance 1999/2, Praha 8

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Distinguished Lecturer 2023 of the IEEE Magnetics Society

Cylindrical Micro and Nanowires: From Curvature Effects on Magnetization to Sensing Applications

Research on the curvature effects in magnetic nanostructures is attracting much interest as they offer novel alternatives to planar systems. In particular, the cylindrical geometry introduces significant singularities to the magnetic response in ferromagnetic wires just from its curvature that firstly depends on the diameter, length and aspect ratio. The main magnetic configurations include axial, transverse, and vortex (circular with singularity at the axis).

Micrometric-diameter amorphous wires with high magnetostriction remagnetize through an ideal mm-long single domain wall propagating at km/s speeds that result in a square loop. Such bistable behavior and their magnetoelastic properties are the basis for various devices (e.g., stress and temperature sensors, electromagnetic shielding). On the other hand, ultrasoft non-magnetostrictive microwires are employed in very sensitive field sensors based on the giant magnetoimpedance effect or in flux-gates.

Nanowires (20 to 400 nm diameter) present an outstanding behavior where the crystalline structure plays a major role in competition with shape anisotropy. Cylindrical nanowires are considered as scaffolds for advanced 3D nanoarchitectures exploiting intrinsic curvature that introduces significant differences with regard to planar-based nanotechnologies. They are proposed for novel sensor devices and magnets, and their interconnecting arrays are considered for energy devices or brain-inspired computing. An ultimate goal is currently the investigation of the magnetization reversal modes in individual nanowires by advanced techniques (e.g., PEEM/XMCD, MFM, MOKE, Electron Holography, and Micromagnetic Simulations). They show axial, transverse, vortex and more complex exotic magnetic configurations and effects (e.g., magnetization ratchet, skyrmion tube, helical vortex). The reversal nucleates at the nanowire ends involving singularities (e.g, Bloch-point walls) and at local transition regions (e.g., modulations in diameter and compositional modulations between segments of designed different magnetic nature as FM1/FM2 or FM/Non-Magn). Individual nanowires are currently functionalized and proposed for biomedical applications (e.g., oncological, MRI elements or composites for antimicrobial activity).

Seminář proběhne v angličtině. Hlavním organizátorem je Fyzikální ústav Akademie věd ČR.
The colloquium will be held in English. Organised by FZU – Institute of Physics of the Czech Academy of Sciences.