

Low-field directional switching of exchange bias in PtMn/CoFeB

O. Zadorozhnii¹ and V. Uhlíř^{1,2}

¹*CEITEC BUT, Brno University of Technology,
Purkyňova 123, 612 00 Brno, Czech Republic*

²*Institute of Physical Engineering, Brno University of Technology,
Technická 2, 616 69 Brno, Czech Republic*

The exchange bias (EB) phenomenon, typically observed at ferromagnet/antiferromagnet (FM/AF) interfaces, manifests as a unidirectional shift in the FM magnetic hysteresis loop [1]. The effect is key to a broad range of spintronic technologies, from magnetic sensors to memory elements. A central challenge in the application of EB is its controlled and reversible manipulation. We report a highly directional switching of exchange bias and coercivity in PtMn/CoFeB bilayers using purely magnetic field stimuli on the order of 100 mT. While the exchange bias and coercivity remain robust along the field-annealing axis, showing no training effect, they can be deterministically switched by applying magnetic fields in directions out of the stable range. This behavior demonstrates an exceptional angular selectivity in field-induced exchange bias modulation, distinct from the gradual or periodic angular responses reported in prior studies [2]. Our findings establish a directionally selective and training-free exchange bias control mechanism, offering new opportunities for nonvolatile magnetic memory and logic based on field-only actuation.

References:

[1] T. Blachowicz and A. Ehrmann, *Coatings* 11 (2021) 122.

[2] T. Hajiri, T. Yoshida, M. Filianina, S. Jaiswal, B. Borie, H. Asano, H. Zabel, and M. Kläui, *J. Phys.: Condens. Matter* 30 (2018) 015806