LOB-13. High-coercive PrFeB Films with Strong Perpendicular Magnetic Anisotropy. *J. Soler Morala*[1], C. Navio[1], G. Gkouzia[4], P. Pedraz[1], L. Zha[2,3], J. Yang[2,3], L. Alff[4] and A. Bollero[1] *1. IMDEA Nanociencia, Madrid, Spain; 2. Beijing Key Laboratory for Magnetoelectric Materials and Devices, Beijing, China; 3. State Key Laboratory for Mesoscopic Physics, Peking University, Beijing, China; 4. Materials science, Technische Universität Darmstadt, Darmstadt, Germany*

Rare-earth transition metal thin films hold great potential for implementation in devices at the micro and nanoscale [1-3]. While $Nd_2Fe_{14}B$ and $Pr_2Fe_{14}B$ share almost the same intrinsic magnetic properties (M_s, K_u…), $Nd_2Fe_{14}B$ has a limited use for low temperature applications (i.e. aerospace) due to the spin reorientation that occurs at 135 K [4]. This limitation can be overcome using $Pr_2Fe_{14}B$, whose magnetization direction remains along the c-axis until 4.2 K [4]. The understanding and optimization of these systems is of great importance when attempting their integration in novel miniaturized devices [5]. In this study, high coercivity PrFeB thin films of 100 nm have been fabricated by magnetron sputtering. The effect on the substrate temperature (T_s) in the structure and morphology and its resulting impact on the magnetic properties has been evaluated. Our research stablishes the optimum T_s to be 600°C where a highly textured growth of $Pr_2Fe_{14}B$ is achieved according to the X-Ray Diffraction (XRD) analysis (Fig. 1a). $Pr_2Fe_{14}B$ crystalline phase is accompanied by a Pr-rich phase that can be identified in all the XRD patterns. The role that these Pr-rich areas play in the magnetism of these systems has also been thoroughly studied by Energy Dispersive X-Ray Spectroscopy (EDX) (Fig. 1c). Regardless of T_s, all films present strong perpendicular magnetic anisotropy (Fig.2c,d) which is in good accordance with the c-axis oriented preferential growth. Out of plane coercivities up to 14 kOe have been obtained at RT. Atomic and Magnetic Force Microscopy (AFM and MFM, respectively) have also been used to determine influence of T_s on the roughness and magnetic domains (Fig 2a,b).

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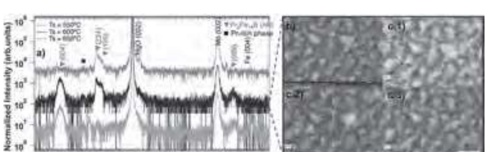

Fig. 1. a) XRD pattern of PrFeB thin films grown at different Ts, b) Scanning electron microscopy (SEM) image of a PrFeB film grown at 600°C, c) EDX mapping of a PrFeB film with a Ts = 600°C showing the distribution of Pr and Fe (c.1) Prdistribution (c.2) Fe distribution (c.3). The scale bar is 800 nm in all cases.

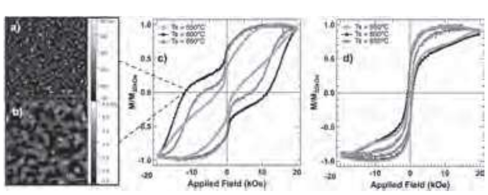

Fig. 2. a) AFM and b) MFM image of a PrFeB film grown at 600°C, c) Out of plane and d) In Plane room temperature hysteresis loops with a maximum applied field of 20 kOe for PrFeB thin films grown at different Ts.

LOB-14. Chirality-induced asymmetric magnetization reversal in perpendicularly exchange biased micro stripes. *S. Akhundzada*[1], P. Kuswik[3], M. Kowacz[3], C. Janzen[1], T. Mewes[2], A. Ehresmann[1] and M. Vogel[1] *1. Institute of Physics and Center for Interdisciplinary Nanostructure Science and Technology (CINSaT), University of Kassel, Kassel, Germany; 2. Department of Physics and Astronomy, University of Alabama, Tuscaloosa, AL, United States; 3. Institute of Molecular Physics, Polish Academy of Sciences, Poznan, Poland*

Hybrid magnetic layer systems consisting of a heavy metal, an ultrathin ferromagnet (F), and an antiferromagnet (AF) are interesting material systems that potentially exhibit both the interface-driven exchange bias (EB) effect and the asymmetric exchange interaction, known as Dzyaloshinskii-Moriya interaction (DMI) [1]. The DMI is essential for stabilizing chiral spin-structures like skyrmions, which are promising candidates for magnetic memory technologies [2]. Due to the DMI and the resulting Néel domain walls with chirality set by DMI, tilted magnetic moments are present at the domain edges [3]. Experimentally, this effect has been observed as asymmetric domain propagation while applying in-plane and perpendicular magnetic fields simultaneously [4]. While the DMI and EB can be modified independently from each other [5], only few studies so far have focused on the interplay between chiral DMI and the unidirectional EB anisotropy, affecting the magnetic domain texture and the resulting magnetization reversal. We report on a systematic study of the magnetization reversal in perpendicularly exchange biased Ti/Au/Co/NiO/Au micro stripes by high-resolution Kerr microscopy. Thereby, the magnetization reversal process is observed to be asymmetric with respect to the two branches of the hysteresis loop. We are able to quantify this as an asymmetry of the nucleation density formed in the two field branches as a function of the structure width. Additionally, a local asymmetry in the domain nucleation and domain wall movement within each stripe is observed. This phenomenon is investigated by field-cooling and the application of additional in-plane magnetic fields during the magnetization reversal. Additionally, XMCD/XMLD-PEEM experiments were performed to reveal the corresponding domain patterns in the F and AF. The results pave the way in the understanding of the interplay between chiral DMI and the unidirectional EB anisotropy in micro- and nanostructures.

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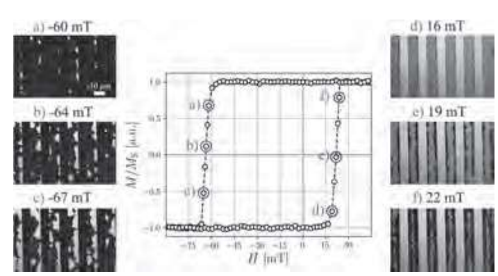

Fig. 1: Asymmetric nucleation in 10 μm wide Ti/Au/Co/NiO/Au stripes. The Kerr images show that for the decreasing field branch a)-c) the domains are formed preferentially at one edge, smaller ones are formed equally at both edges for the increasing field branch d)-f).