SUPPLEMENTARY MATERIAL

Observation and formation mechanism of 360° domain wall rings in Synthetic Anti-Ferromagnets with interlayer chiral interactions

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CONTENTS

SM 1. Comparison of XMCD-PEEM images at Fe and Co edges

Figure 1 shows XMCD-PEEM images recorded at both cases discussed in the main text, *i.e.*, where $\vec{B}_{IL-DMI}$ is fully (green) and partially (red) compensated by the external field constant offset $\vec{B}_{ext}^{DC}$. In both green and red cases, the magnetic features appreciable at the two edges are identical, showing significantly better signal-to-noise ratio in the Co-edge than in Fe due to the larger Co stoichiometric proportion in the CoFeB layer (Co 60% vs Fe 20%). The fact that the magnetic features are identical enable to assume that no contrast from the bottom Co layer leaks through in the XMCD images (within the noise levels), and the signals recorded emerge fully from the CoFeB layer. Thus, for the quantitative vector reconstruction, Co-edge XMCD-PEEM images are used referring to states forming within the CoFeB.

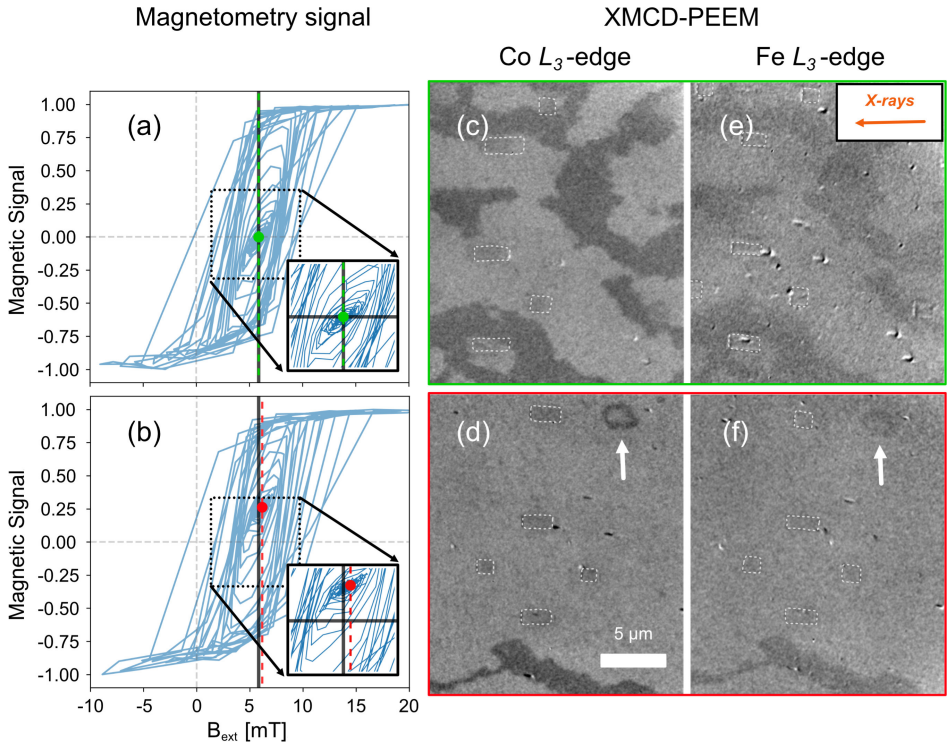

Figure 1: (a,b) XRMS hysteresis loop measurements taken with circular incident polarization during application of the demagnetization procedure described in the main text, with $\vec{B}_{ext}^{DC}$ fully and partially compensating the IL-DMI effective field. (c,e) XMCD-PEEM images corresponding to the IL-DMI fully compensated case (green) measured respectively at Co and Fe's L_3-edge. (d,f) Analogous XMCD-PEEM images recorded for the case where IL-DMI is partially compensated (red).