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Study of Magnetization Reversal in Layered Heterostructures by Vector-Magnetometry

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Vector magnetometery refers to simultaneous measurement of two magnetization components (along the applied field M_x and perpendicular to it M_y) during the hysteresis measurement. This offers the possibility to distinguish between different mechanisms of reversal as for a domain wall dominated reversal the perpendicular component remains negligible while in contrast for a homogeneous rotation a strong contribution is expected. Thus $\sqrt{M_x^2 + M_y^2}$ can be used as measure of the homogeneity of the reversal as it remains constant for a purely homogeneous rotation while it dips to zero (at coercivity) for a purely domain wall based one. Here the reversal mechanisms are studied by Vector magnetometry at different angles (θ=0°,15°,30°,45°,60°,75°,90°) to the film plane in different multilayered heterostructures with mixed anisotropies: For the $[Co(6Å)/Pt(15Å)]_4/(Pt(t))/[Co(10Å)/Pt(15Å)]_4$ with t=0-45Å series consisting of a perpendicular anisotropy bottom four-bilayer-stack coupled to a vanishing anisotropy top four-bilayer-stack through a variable thickness Pt interlayer, evidence of decoupling and homogeneous rotation of the top stack is clearly observed at for θ=30-75°. Similar behavior is observed for a $[Co(6Å)/Pt(15Å)]_4/W(15Å)/Co(24Å)$ sample consisting of a perpendicular anisotropy bottom four-bilayer-stack coupled to a vanishing anisotropy top Co layer through a non-magnetic W layer (permitting only dipolar coupling) in the plateau between the reversal of the two components. In contrast for the $Co(6Å)/Pt(15Å)]_4/W(15Å)/[Co(6Å)/Pt(15Å)]_4$ sample where two identical perpendicular anisotropy stacks are separated by a decoupling W layer the reversal follows the typical domain-wall propagation reversal. The same holds for $[Co(5Å)/Pt(10Å)]_6/Pt(x)/[Ni(15Å)/Pt(5Å)]_6$ series consisting of two six-bilayer-stacks having both perpendicular anisotropy but different coercivities.

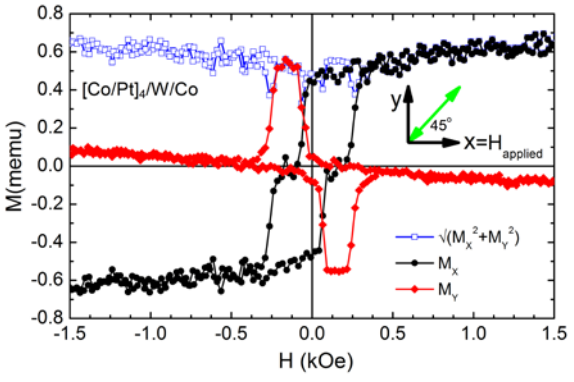

Fig.1 Typical Vector Magnetometery measurement for a $[Co/Pt]_4/W/Co$ multilayer sample.