Controlled positioning of domain walls in Co/Au multilayers by He^+ ion bombardment induced lateral coercivity gradients

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9.7 cm

The current trend for on-chip integration of chemical and/or biological agents detection capabilities results in designs of new systems, some of which utilize the stray fields of magnetic domains for manipulation of paramagnetic particles. In this contribution we show that the introduction of structural defects into magnetic layers having perpendicular magnetic anisotropy by means of 10 keV He^+ ion bombardment through 0-100 nm thick Au wedge can create anisotropy gradients in the Co sublayers of a $[Co(0.6\,nm)/Au(2\,nm)]_3$ sputter deposited multilayer (ML). The thickness of the wedge determines the energy and fluence of ions reaching ML. Along the bombarded stripes coercive field of Co layers changes monotonically and for certain wedge-thickness ranges almost linearly along the wedge. Within such a layer system domain walls between up and down magnetized areas can be controllably moved by an external perpendicular homogeneous magnetic field over distance of several millimeters along the surface of the structure[1]. This method and layer system is promising for a controlled magnetic particle transport within the stray fields of the moving domain walls and for sensor applications.

[1]M. Urbaniak et al., Phys. Rev. Lett **105**, 067202 (2010)

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