Interfacial diffusion controlled magnetisation reversal and domain state modulation in hard/soft multilayers

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Abstract

The implications of soft underlayer and overlayer on the hard magnetic layer on the static and dynamic magnetic properties of hard/soft exchange spring system are discussed. High energy synchrotron X-ray diffraction by varying glancing angles unveiled structural variations at the interface, in the bilayers viz. FeCo/FePt system. A soft ferromagnetic in-plane behavior and defect-driven hard ferromagnetic properties in the out-plane configuration are established. Besides, the magnetization dynamics studied by Ferromagnetic Resonance depicting the easy direction of magnetization of the hard and the soft component shows a marked variation depending on the order of stacking of the hard/soft layer. X-ray Absorption Spectroscopy (XAS) in the Fe, Co and Pt L-edge regions reveal dissimilar interfaces in the two series due to thermal agitation effects. Charge redistribution occurs between Fe, Co and Pt ensuring increased Co–Pt and Fe–Pt interactions with higher diffusion. Thereafter, we combine hysteresis and magnetic force microscopy measurements to show that the interfacial deformations result in the distinct out-plane magnetic behaviour of the system. Such structures are useful for spin-wave assisted low field magnetization switching in highly coercive FePt by using exchange coupled soft FeCo. These diffusion-mediated magnetic properties of the FePt/FeCo system are important to study for achieving the desired characteristics in the system.

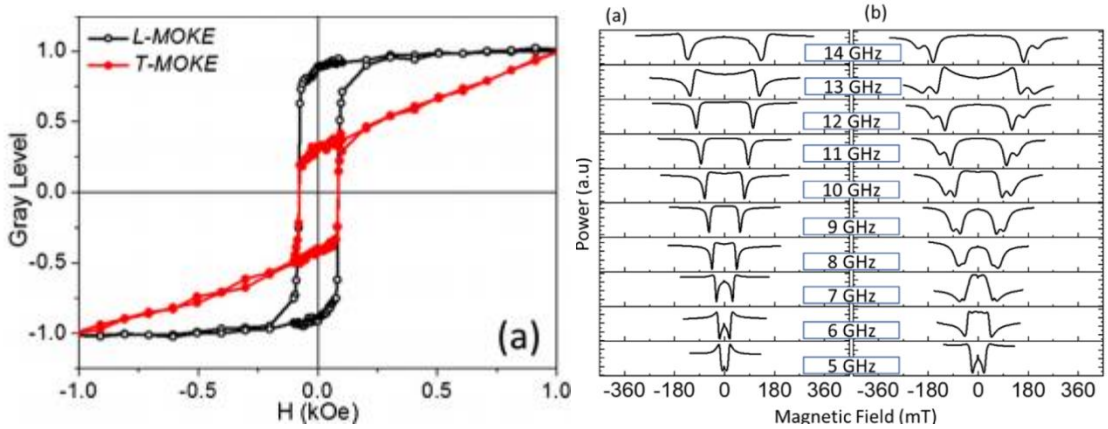

Fig 1 L-MOKE and T-MOKE hysteresis loop and (2) FMR spectra obtained in the broad frequency range of 5–15 GHz for FeCo/FePt bilayers

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