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Novel materials and media concepts for thermally assisted magnetic recording.

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Magnetic media using materials with high uniaxial magneto-crystalline anisotropy, K_U, combined with a thermal assist to overcome thermal stability and write field limitations are widely seen as a potential extension of current magnetic recording technology. Here we present an overview of recent work on adapting the thermo-magnetic properties of FePt-based high-K_U materials for the requirements of such a recording system. In [1] we recently proposed a novel media structure consisting of two exchange coupled films, a high anisotropy film like, e.g., FePt, and a FeRh film. At close to equiatomic compositions FeRh is an antiferromagnet at low temperatures. Interestingly, upon heating beyond a critical temperature, T_{AF-FM}, FeRh becomes ferromagnetic for temperatures $T_{AF-FM} < T < T_C$. This opens interesting possibilities for media applications for thermally assisted recording: at a storage temperature, $T_S < T_{AF-FM}$, the magnetic information is stored in the high-K_U FePt layer. For writing at increased temperature, $T_{AF-FM} < T_W < T_{C-FeRh}$, the FeRh becomes ferromagnetic, effectively lowering K_U and increasing the total magnetic moment of the bilayer, thus lowering its coercivity via an exchange spring mechanism and helping magnetization reversal at temperatures well below T_C of the FePt layer. A related area of great interest is the magnetization dynamics upon rapid heating and cooling of FeRh films using *fs*-laser pump-probe techniques. First results indicate that the AF-FM transition can be driven on a timescale below 1 *ps* [2], yielding interesting insight into the interaction of the spin, electron and lattice subsystems.

[1] J.-U. Thiele, S. Maat, E. E. Fullerton, Appl. Phys. Lett. **82** (2003) p2859-2861
[2] J.-U. Thiele, M. Buess, C. H. Back, Appl. Phys. Lett. **85** (2004) p2857-2859 and G. Ju *et al.*, Phys. Rev. Lett. **93** (2004) 197403.