Graphene as protective coating for ultra-high storage density hard disks

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Abstract
Current data storage technology is facing barriers to progress in terms of achievable storage densities [1,2], power consumption [1,2] and data rates [1,2]. To achieve high areal density beyond 1Tb/in^2 the magnetic spacing in hard disks has to be reduced [3-5]. Due to its monoatomic thickness and excellent lubricity [6,7], graphene is ideally suited to beat the thickness limits of current diamond-like carbon coatings. We use single layer graphene (SLG) to 4 layers graphene (4LG) transferred on magnetic media, Fig. 1a), and perform corrosion and tribology tests with and without lubricant, and compare the results to bare media and commercial media, Fig. 1b). Graphene exhibits superior properties compared to filtered cathodic vacuum arc and sputtered amorphous carbon. We demonstrate a stable, low friction coefficient ~0.1 for 16650 cycles for 3LG with lubricant. We measure a corrosion current of 3.5nA/cm^2 for 4LG, lower than in commercial media. Our data show that graphene can enable the development of future very high magnetic data storage areal density hard disk drives ~10Tb/in^2 when using appropriate magnetic recording technology, such as heat assisted magnetic recording (HAMR) combined with bit patterned media (BPM). This is a ~10-fold improvement compared to present technology.

References
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Figures

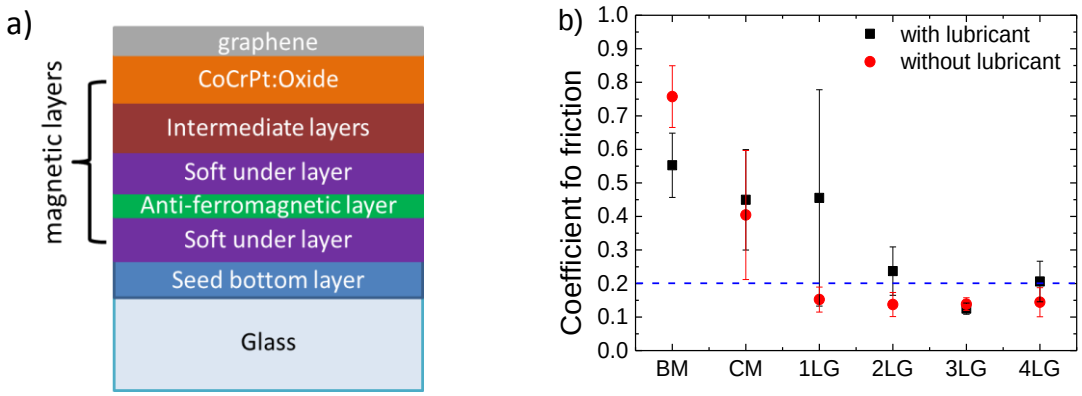

Fig. 1. a) Cross sectional schematic of hard disk with graphene. b) Coefficient of friction for bare media (BM), Commercial media (CM), as well as 1 layer to 4 layers of graphene.