

Magnetic Nanostructures Designed For Hard Disk Drive Applications

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Continued progress in hard disk drive areal density for conventional perpendicular magnetic recording (PMR) based on granular media has become increasingly difficult [1]. Although adoption of energy assisted magnetic recording (EAMR), specifically Heat Assisted Magnetic Recording (HAMR) [2] is widely viewed as a promising solution for thermal stability issues, challenges in grain size scaling and managing media noise may limit the rate of progress for EAMR based on granular media. Bit patterned recording (BPR) stands as an attractive alternative to granular media, offering a path to thermally stable recording at high density and significantly reduced media noise by replacing the segregated random grains of PMR media with lithographically defined single domain islands [3,4]. Figure 1 compares and summarizes basic characteristics of currently used conventional PMR based on granular media and BPR based on pre-defined bits.

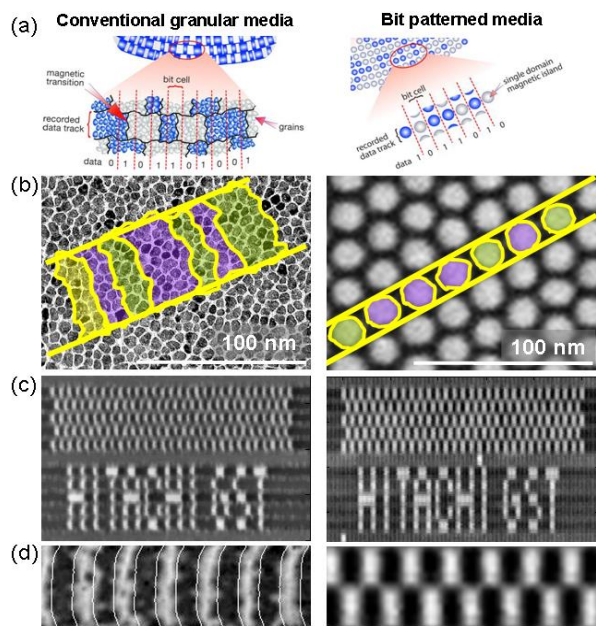


Fig. 1. Comparison of granular PMR (left) and BPR (right) media systems. (a) Bit scheme for both recording systems. (b) Bit definition within the lateral recording media microstructure. (c) Comparison of static read/write testing on both media systems. (d) High resolution images with alternating up-down bit structure for both recording systems. Bit dimensions in (c) and (d) are 145 nm cross track and 45 nm down track (~ 100 Gb/in²).

In my talk I will discuss various choices for BPR magnetic materials, such as Co/Pd and Co/Pt multilayers as well as CoCrPt and FePt L1₀ alloys. I will highlight advantages and disadvantages of the different magnetic material systems with respect to potential applications in BPR and outline the specific challenges when comparing conventional PMR, BPR and currently emerging HAMR systems.

Keywords: magnetic recording, hard disk drive, perpendicular magnetic recording, bit patterned recording, heat assisted magnetic recording

References

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