

Lithography Challenges and Opportunities in Bit Patterned Media at 1.5 Tdots/in² and Beyond

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Bit patterned media (BPM) is one of the advanced technologies that are currently being considered to satisfy the ever-increasing demand for higher storage capacity in the magnetic recording industry. However, BPM presents extreme challenges to lithography because of the small feature size and the tight spacing tolerance. Directed self-assembly (DSA) of block copolymers has been proposed as a viable lithography strategy for BPM application. In this work, we have demonstrated a DSA process with sphere-forming PS-*b*-PDMS pattern (hcp) at the density up to 3.2 Tdpsi over large area (Figure 1). A servo-integrated BPM template with DSA has been successfully fabricated by a two-step-DSA integration scheme at 1.5 Tdpsi, which contains the periodic patterns in data zone and non-periodic patterns in servo zone (Figure 2). Further, the fabricated template has been used for imprint lithography on 2.5" disks, followed by a pattern transfer into a magnetic thin film layer using ion beam etch to form patterned magnetic media (Figure 3). The integrated servo in the media is used to close loop and provide timing information. The successful integration of servo patterns enables us to perform a spindrive test demo at 1.0 Tdpsi with BER -2.43 (Figure 4). Although a significant progress in our 1.5Tdpsi demo has been achieved recently, many challenging lithography issues still remain, such as skew limitation, density extension ability, and sigma control. Possible solutions such as patterned rectangular media and double patterning process will be discussed.

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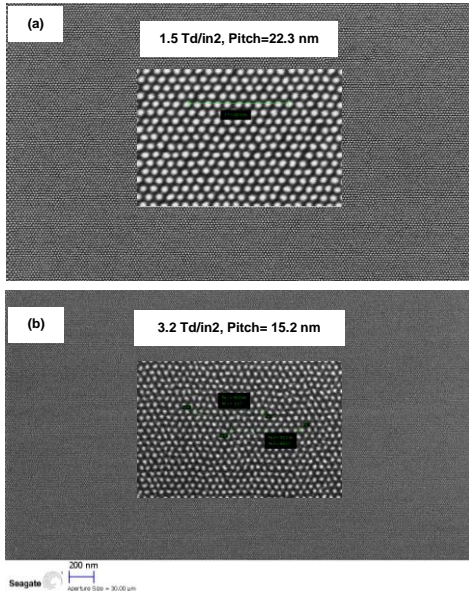


Figure 1 SEM images of PS-*b*-PDMS at 1.5 Tdpsi and 3.2 Tdpsi

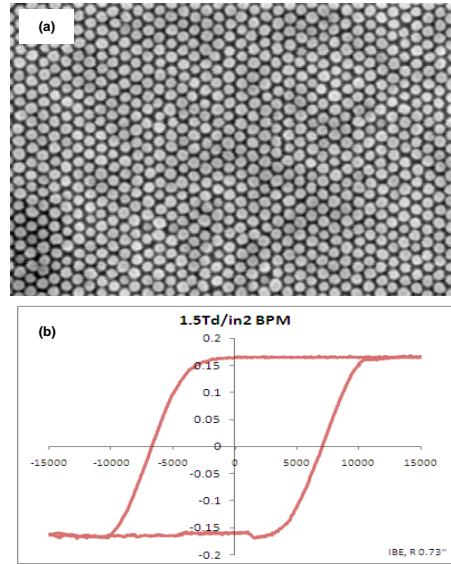


Figure 3 SEM image of 1.5 Tdpsi magnetic dots with magnetic loop

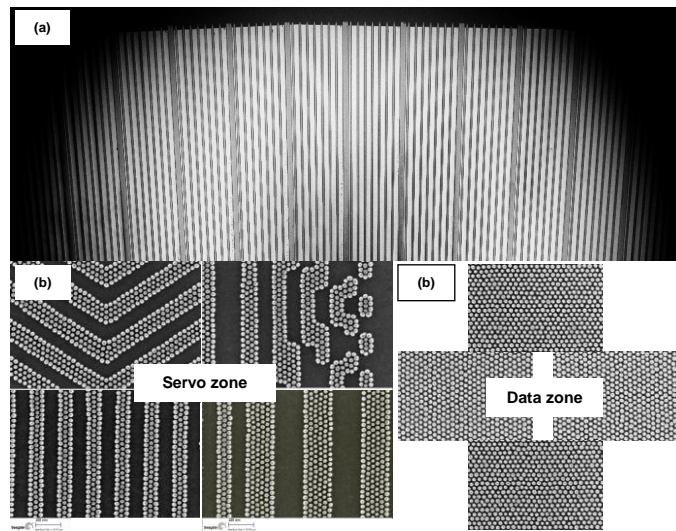


Figure 2 SEM images of 1.5 Tdpsi servo-integrated template showing both servo zone and data zone

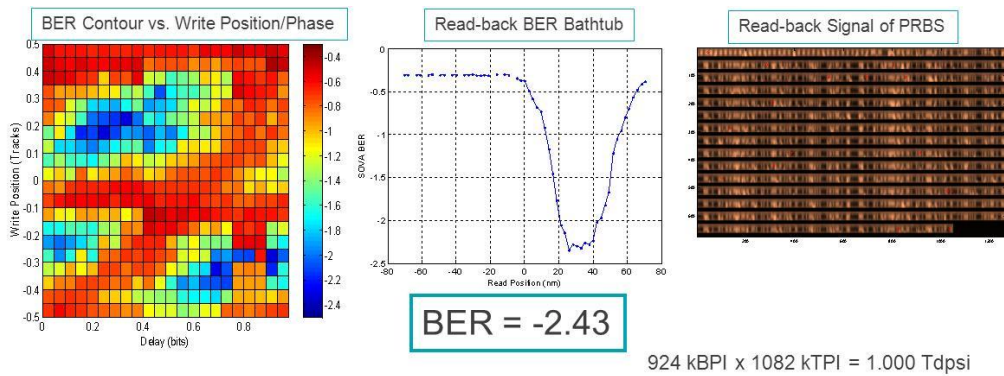


Figure 4 Spinstand BER -2.43 demonstration at 1.0 Tdpsi