Progress and Challenges in Bit Patterned Media Nanofabrication

XiaoMin Yang, Shuaigang Xiao, Kim Lee, Gene Gauzner, Koichi Wago, Rene van de Veerdonk, and David Kuo

Seagate Media Research, Fremont, CA 94538

There are still many technical challenges in BPM nanofabrication. Conventional wisdom envisions a manufacturing process that involves fabricating a "perfect" master template using directed block copolymer self-assembly lithography from which tens of thousands of disks are replicated by a nanoimprint lithography process. The imprinted patterns are then transferred into disks by using either a RIE or ion milling process, thus forming 1 Terabit/in.^{2} (25 nm pitch) periodic arrays of isolated magnetic islands. Besides the requirements for a very precise nano-patterning process, high throughput and manageable costs are also critical for this technology to be of value to manufacturing.

In this presentation, we will give a status update of our recent progress and discuss about the challenges. A concentric full track pillar-tone quartz template with areal density over 1 Terabit/in.^{2} was successfully fabricated by combining rotating electron beam lithography with directed block copolymer assembly. 1 Terabit/in.^{2} hole-tone resist dot pattern was formed on a 2.5" disk by using a full-track template with UV imprint lithography. A reverse-tone process was used to create a thin hard mask layer that is needed in the following dry ion milling etch process to form 1 Tbit/in.^{2} magnetic islands. We will present preliminary results on size sigma, positioning accuracy, and switching field distributions of the magnetic dots. Several key engineering challenges associated with BPM fabrication will be addressed, such as servo pattern integration with BCP material, defect reduction in master template and in magnetic dot formation process, and the improvement of magnetic signal uniformity.

*Email: xiaomin.yang@seagate.com