

EA05

**Fabrication of Bit Patterned Media Using Multi-layer Soft Stamper  
Nanoimprint and Electro Deposition**

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In this research, bit patterned media [1] with 50nm pitch size was fabricated with several serial process consists of master patterning with e-beam lithography followed by Si etching process, multi-layer soft stamper replication, UV-embossing and magnetic material filling by electro-deposition.

To obtain the master of nano size bit patterns with good pattern shape, multi-shot exposure method was introduced. Figure 1 shows the SEM image of Si master fabricated with this e-beam lithography process and precise Si etching process.

This master was replicated with multi-layer soft stamper replication process. Figure 2 show the structure of multi-layer soft mold which is composed of transparent back-plate, polymer, SiO<sub>2</sub>, thin film layer and self assembled monolayer. With this stamper structure not only easy demolding and durability of stamper was obtained but also macroscopic softness that enables conformal contact and microscopic rigidity for nano size pillar replication without buckling were acquired. For the UV-embossing process nanoimprint machine with which precise replication with near zero residual layer is possible was made in-house. Figure 3 show the SEM image of nanoimprinted pattern on metal coated Si substrate.

Finally holes of 25nm diameter on the nanoimprinted substrate were filled with CoP and CoPt by electro-deposition method, and the magnetic properties were measured with SQUID and MFM. Figure 4 and 5 show the M-H loop and MFM image after DC erasing respectively. From this result perpendicular magnetic anisotropy of the developed bit patterned media was identified.

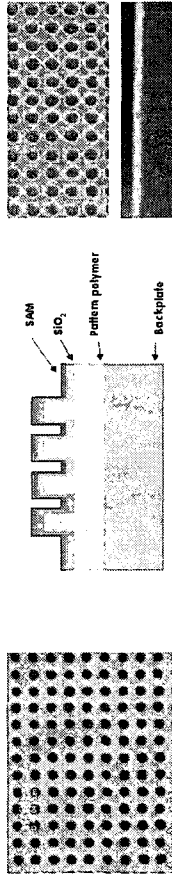


Fig. 1. SEM image of 50nm pitch Si master

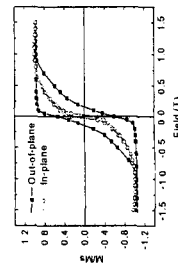


Fig. 2. M-H Loop of developed bit patterned media

Fig. 2. Structure of multi-layer soft mold stamp



Fig. 3. SEM image of nanoimprinted pattern on metal coated Si substrate



Fig. 4. MFM image of bit patterned media after DC erasing.

EA06

**Patterned Magnetic Media - Investigation of Nano-fabrication  
and Switching Properties**

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Patterned media has drawn a lot of attention in the field of magnetic data storage, owing to its potential of providing very high data storage rates. Nano-imprint technology offers a promising low-cost and efficient approach for the fabrication of high density discrete track and bit patterned media. In this talk we would like to share our views on some of the important fundamental issues related to this area. We will talk about critical aspects in the nano-fabrication of high density patterned magnetic media. We will also discuss physical properties, especially magnetic and switching properties of the patterned nanoscale materials. Results from recent investigation on fabricating discrete tracks and bit patterned media will be presented. In our study, high density patterns from 50nm to 500nm pitch have been generated by nano-imprinting lithography techniques with both photo and thermal curable resists. Consequent pattern transformation onto magnetic layers has been accomplished via reactive ion etching and ion milling, etc. Final removal of resistal resist was done by incorporating a sacrificial lift-off layer in order to produce a smooth, flyable media surface. Investigations of magnetic property and switching behavior were carried out using magnetic force microscopy (MFM) and KERR Effect measurement. Results from different types of patterned Co<sub>1-x</sub>Pt<sub>x</sub> alloy and Co/Pt multi-layered materials will be discussed.