



PONDICHERY UNIVERSITY
School of Physical, Chemical & Applied Sciences
Department of Physics

Invited Lecture

On
Polymer Templated Lithography for Patterned
Media Applications

By

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Date: 25th March 2013.

Time: 3.00 PM

Venue: Raman seminar Hall, Dept. of Physics.

All are invited
Head of the Department of Physics

Polymer Templated Lithography for Patterned Media Applications

Magnetic disk drive technology has successfully reduced the size of multi-grain bits to ~30 nm, and there are intensive efforts to shrink the bit size further. The new generation hard disk drives shipped by Seagate Technologies' around August 2009 boasts of recording densities of around 500 GB/inch² using a combination of vertical recording, write head lithography, use of magnetoresistance sensors and better recording media. Though the research and development in this field is progressing at a fast pace the areal densities achievable using conventional scaling is limited to the so-called trilemma problem of satisfying the concurrent requirements of thermal stability, writability, and achieving a high signal to noise ratio.

Though technologies such as heat assisted recording and phase change memory are being explored as future data storage technologies, there has also been great interest in bit patterned media (BPM), where arrays of isolated magnetic nanodots act as individual bits which can be read and written by controlling their magnetization. One of the obvious advantages of BPM technique is that it would allow us to write one bit on a single grain as compared to the standard procedure of averaging a single bit over 25 – 30 grains (to prevent data loss due to thermal fluctuations and the demagnetizing field of the adjacent grains). This in turn would directly lead to a 30 fold increase in the storage capacity of the typical hard disks theoretically pushing storage densities to achievable upper limit of

around 30 TB/inch². Further, this technique significantly reduces the jitter noise which gives it a significant advantage over other techniques.

Though the concept of patterned media has been around for over two decades the technology has not been able to achieve technological fruition as the lithographic fabrication of nanodots is commercially prohibitive due to issues of scalability and throughput. Hence, it is critical to develop highly cost effective solution for fabrication of BPM. Further, it is equally important for the thus fabricated media to satisfy the concurrent requirements of the aforementioned “trilemma problem” of magnetic recording.

In this work, a novel cost effective technique of fabricating large arrays of magnetic nanodots towards bit patterned media applications was developed. Ferromagnetic nickel nanodots were fabricated by electron beam evaporation using a nanoporous polysulfone membrane as a mask. The polymer templated soft lithography technique used is a simple, inexpensive and scalable technique of synthesizing inorganic nanodots and can be extended to fabricate any metal, metal oxide, metal compound and metal alloy nanodots. Based on this, the applications of this fabrication technique can extend over several domains including fabrication of ultra fast data processing devices, sensors, nano electronics, nanoarray, lab-on-a-chip, etc.