Whitepaper

New Storage Media Production Technique Enables Greater Storage Density

Electronics developers continue to place demands on magnetic storage technology, striving to fit increasing amounts of data on shrinking form factor products. In order to realize a new generation of products with greater storage densities, the technologies for the storage media and the read- and write-heads of the storage devices must undergo major transformations. This document provides a topline on significant developments in storage media technology.

To create a new generation of media with greater storage densities, the capabilities of the media must be increased relative to its essential attributes: magnetic stability, capacity and addressability. A breakthrough enabling advances in each of these attributes has come from outside the realm of storage media materials. It has long been known that the anodization of aluminum—which produces alumina (aluminum oxide)—pits the surface of the alumina at the nanometer scale, resulting in nanoholes. This pitting is the effect that allows color to be adhered to anodized aluminum.

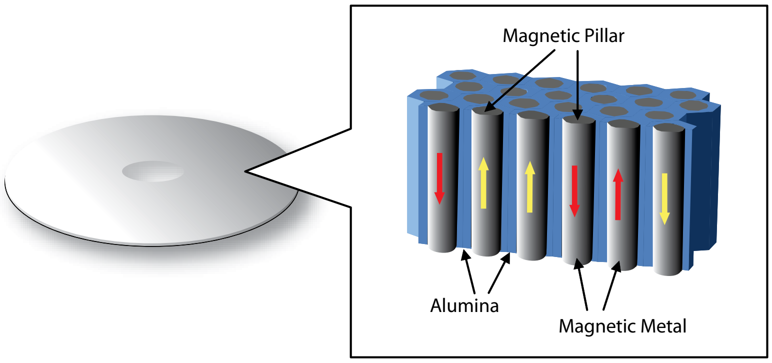

Figure 1

An important characteristic delivered by the nanohole construct is the magnetic stability of the media. In order to render a nanohole landscape into magnetic storage media, magnetic material must be introduced. Utilizing electrodeposition, cobalt—a conventional advanced magnetic storage material—can be introduced into the nanohole. The result is the discrete pillar structure shown in Figure 1.

When constructed in this fashion, the alumina serves as an isolating barrier for the discrete elements of the media. This enables each pillar of magnetic material to be charged as a single data bit with no crosstalk or corruption of adjacent bits. Hence, the nanohole construct addresses not only raw media density, but magnetic stability as well.

In 1997, Professor Masuda's group[1] formulated a process to control this pitting effect. The method uses a mold with an array of lumps arranged in a hexagonal pattern to "pre-pit" the aluminum. The resulting nanoholes have an extremely dense yet ordered structure.

The nanoholes offer the realistic prospect of being uniformly produced at a pitch of 13nm. This would yield a density of 4 x 10^{12} / sq. inch. If each nanohole is charged as a single data bit, their size translates into a prospective storage density of 4Tbit/ sq. inch. This is significantly greater than what is currently available, and far beyond what is even theoretically possible using existing media.

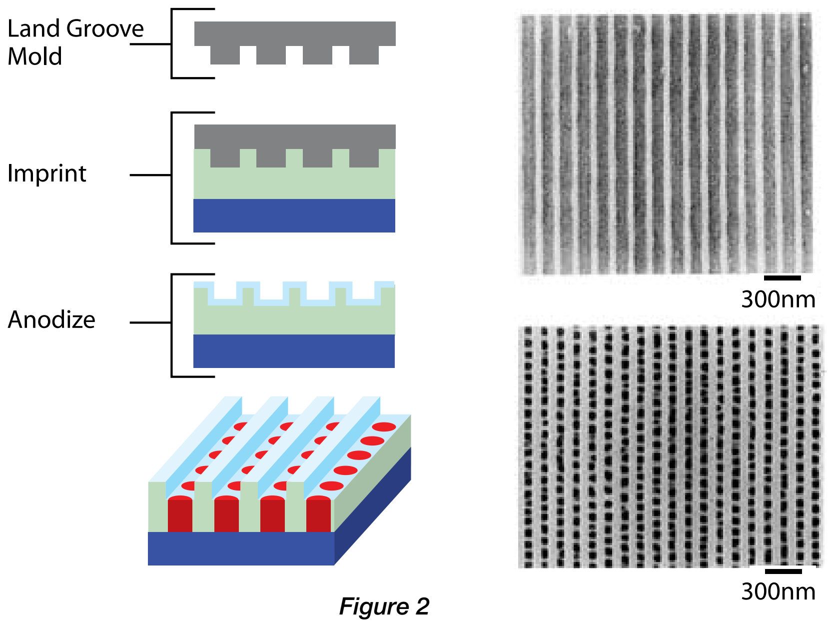

Figure 2

The incredible density and specificity of media that is patterned using nanoholes introduces unique challenges for addressing the data. To accomplish this, yet another new technique is required. Yamagata Fujitsu, Fujitsu Laboratories and KAST (Kanagawa Academy of Science and Technology) have devised a technique called land/groove texturing. Land/groove texturing uses a mold on the aluminum base—preparatory to the application of the patterning mold—to create discrete tracks in which the nanoholes can be formed. Figure 2 shows the effect this has on the resulting media matrix and Figure 3 compares the nanohole construct with and without land/groove texturing with a groove pitch down to 45nm.

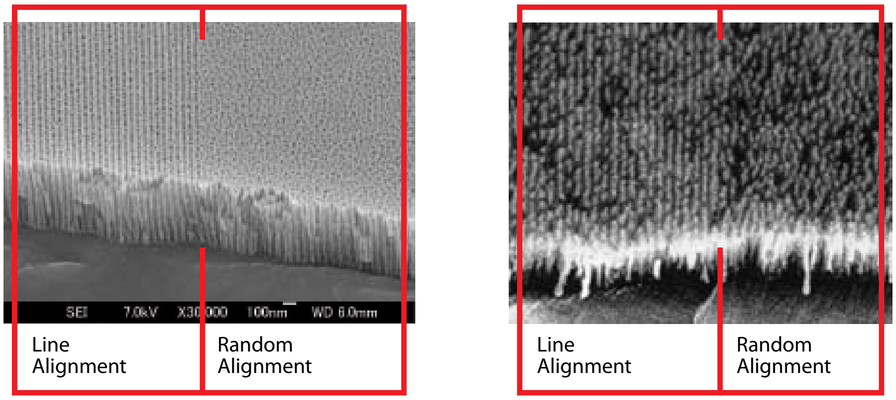

Figure 3

With the nanoholes ordered in tracks, it is possible to implement an addressing scheme that will make the new, denser media practical for conventional applications.

The patterned media solution enables the development of mass storage devices with densities never before possible. In turn, this will allow the development of end-user products featuring smaller form factors and increased storage capacities. With the digitization of more forms of visual and audio information, the new media will enable products of greater versatility and portability.

Patterned media represents one of three elements necessary to produce higher density and reduced form factor storage components. Fujitsu is continuing to refine the patterned media techniques and the ancillary technologies. Fujitsu anticipates offering Tbit/sq. inch media by 2010.

Patterned media work is supported by the "Research Program on Development of Innovative Technology" of Japan Science and Technology Agency.

About Fujitsu Computer Products of America, Inc.

Fujitsu Computer Products of America, Inc. is a subsidiary of Fujitsu Limited, a leading provider of customer-focused IT and communications solutions for the global marketplace. FCPA provides innovative solutions for the U.S. marketplace. Current product and service offerings include: high performance hard disk drives, Magneto-Optical drives, scanners and scanner maintenance, palm vein recognition technology, 10Gb Ethernet switches and degaussers.

[1] *Highly Ordered Nanochannel-Array Architecture in Anodic Alumina, H. Masuda, H.Yamada, M.Satoh, H.Asoh, M.Nakao, T.Tamamura, Appl. Phys. Lett., 71, 2770 (1997).*

Whitepaper

Fujitsu Computer Products of America, Inc.
www.fcpa.fujitsu.com
1255 East Arques Avenue, Sunnyvale, CA 94085-4701. (800) 626-4686 (408) 746-7000 info@fcpa.fujitsu.com

FUJITSU

THE POSSIBILITIES ARE INFINITE

Printed in the U.S.A. Qty. 1M WP10400206