800Gbit per sq in and beyond

Data Recovery

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Consumer desires for ever greater hard disk drive (HDD) storage capacity are placing the manufacturing industry under increasing pressure to address the limitations of the current perpendicular magnetic recording (PMR) technology.

Perpendicular Magnetic Recording

PMR currently enables an areal density of around 500Gbit/sq in but the size of the magnetised area is so small that the stability of the magnetic poles is reduced making them vulnerable to random heat fluctuations. While it is possible to change the chemistry of the recording layer to prevent this occurrence, the consequence would be an adverse effect on the read/write capability of the HDD.

There are therefore two choices to increase the areal density limit. The first would be to change the chemistry of the recording layer and adapt the technology to improve the read/write functionality, while the second choice would be to rely on the existing chemistry and insulate the bits to make them less vulnerable to heat changes. The first of these technologies is referred to as heat-assisted magnetic recording (HAMR) and works by heating the bit before writing the data. However this requires the addition of a laser heating element to the write head which means that the head is consequently more bulky than non-HAMR heads and may prove too large for 2.5" and 1.8" HDD casings.

The second possibility is to protect the bits from random heat changes by insulating them. This technology is called bit-patterned media (BPM) and is allied to a technology introduced in 2007 by Toshiba known as discrete track recording (DTR). DTR relies on

"grooves" in the recording layer which improve signal quality by eliminating magnetic transition noise. Toshiba, strengthened by its recent acquisition of Fujitsu, is planning to continue to develop DTR in 2010 for 2.5" drives followed on by the development of BPM technology (for 2.5" drives) and HAMR technology (for 3.5" drives) in 2012. It has been reported that Seagate are concentrating on the development of HAMR, while Hitachi are considering both possibilities.

So what changes can we expect to see in areal density, and when can we expect to see them? A source within Xyratex has suggested that in the next two years we will see areal density limits reaching 800Gbit/sq in with PMR and DTR, after which time the newly developed HAMR and BPM will be needed to effect further increases. By 2014/2015 we may have reached the limits of the new technologies and will probably be entering a post-PMR era.

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