Hitachi Shows Technical Feasibility Of Perpendicular Magnetic Recording At 610 Gbit/in2

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Hitachi, Ltd. announced today that it has demonstrated the technical feasibility of magnetic recording at 610 Gbit/in2. This considerably exceeds the previously demonstrated capabilities of current perpendicular recording technology found in mass-production hard disk drive (HDD) products. These results hold the potential for a 2.5x increase in the storage capacities of current-generation HDDs.

Hitachi has successfully verified an areal recording density of 610 Gbit/in2, using conventional perpendicular magnetic recording with continuous recording media and a software detection model. This achievement provides further evidence that hard drive capacities have the potential to advance at a rate of 40% annually. Application of this technology to future HDD products is expected to result in products that deliver larger capacities, smaller sizes and greater energy efficiency.

Hitachi will present its findings at The Magnetic Recording Conference (TMRC), taking place in Singapore from 29th to 31st , July 2008.

"These results are based on many years of experience with design optimization and material technology for perpendicular recording heads and media. We applied this knowledge to the development of heads and media with an ultra-narrow track pitch of 65nm, indispensable in achieving a recording density of 610 Gbit/in2. Development of iterative signal processing technology for high density recording further increased

density and capacity," said Hiroaki Odawara, Research Director, Storage Technology Research Center, Central Research Laboratory, Hitachi, Ltd.

Hitachi believes that HDDs are an indispensable storage resource for digital home appliances and recording equipment such as large-scale corporate or public databases, PCs and HDD recorders. As the volume of information worldwide continues to grow rapidly, even greater HDD capacity will become necessary.

Perpendicular magnetic recording is now the current mainstream HDD technology. Hitachi GST demonstrated 230 Gbit/in2 in April 2005, 345 Gbit/in2 in September 2006, and has now shown extendability to 610 Gbit/in2. This growth supports the theory that technology can support storage capacity growth of 40% annually. It has been predicted, however, that the current perpendicular recording, which uses a continuous film media will eventually reach a limit in achievable recording density, and therefore, new head and media using alternative technology such discrete track recording, bit patterned media and thermally-assisted recording, are also being considered. These new methods are still being developed, but hold potential for much greater advancements in areal density growth.

Write- and read- head technology for 65nm level track pitch

Continued hard drive advancements require the ability to squeeze more and more, and thus, smaller and smaller data bits onto the recording media, necessitating a decrease in recording track pitch, as well as continued miniaturization of the recording heads to read those bits. As the track pitch narrows, the magnetic field from the write-head interferes with the recorded data in an adjacent track, causing problems such as rewriting or even deletion of data.

To minimize this effect and contain the magnetic field of the head to the relevant track, researchers at Hitachi and Hitachi GST developed a wrap-around shield (henceforth 'WAS') write head for narrow pitch tracks by employing a WAS structure, where the main magnetic pole of the write-head is wrapped with a magnetic shield. A TMR (Tunneling Magneto-Resistive) head, able to maintain a sufficient S/N ratio, was also developed for when the sensor width is narrowed. Technology to optimize the write- and read-head was developed using a separated write- and read- head, and analyzing the performance of each.

New media technology with high S/N ratio for 65nm level track pitch

A recording layer was developed with an anisotropy field gradually increasing in the thickness direction. Generally, the greater the anisotropy field, the more difficult it is to reverse the direction of the magnetic current. However, Hitachi found that in the newly developed recording layer, reversal in a magnetic moment occurs from the area with a low anisotropy field, and this in turn, assists reversal in the areas with a high anisotropy field, thus maintaining high thermal stability as well as achieving high writing capability.

The signal and noise information of the media was also analyzed based on a micro-magnetic model, and an optimal design for the head-and-media combination was developed.

Reed-Solomon error correction code-free iterative signal processing technology

In conventional hard drives, in order to read data without errors, an error correction code is attached when data is recorded. The code, however, occupies recording area, thus reducing user space. A new signal

processing technique, iterative decoding, which does not require a Reed-Solomon error correction code, was developed for the hard drive. This new technique increases user space by approximately 4%, enabling a further increase in storage capacity equivalent to an HDD with a recording density of 635 Gb/in2.

Provided by Hitachi