A 2.5-dimensional magnetic recording scheme could help break the data density barrier

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Writing non-information carrying 'servo' data to a secondary layer enables A*STAR researchers to increase the areal density of magnetic hard disk drives. Credit: Medioimages/Photodisc/Photodisc/Thinkstock

t could soon be possible to squeeze more information onto magnetic hard disk drives using new technology developed by A*STAR researchers that thwarts physical limits on data density by moving head tracking bits to a deeper, second magnetic recording layer.

Hard disk drives consist of a stack of thin spinning magnetic 'platters' that are read and written to using a magnetic read/write head that moves

at high speed just a few nanometers above the platter surface. With all other mechanical components now optimized after many years of development, the density of magnetic bits on the platter has become the crucial determinant of performance and capacity. Researchers and engineers have devised increasingly sophisticated and physically esoteric ways of raising this bit density, but a range of mechanical and physical barriers has presented them with a hard limit of about 1 terabyte per square inch.

Yunjie Chen and colleagues from the A*STAR Data Storage Institute have now found a way to cram in more usable data within these physical limits by moving 'servo' data—data bits required for mechanical stability of the read/write head but which do not carry file data—to a deeper secondary magnetic layer on the disk.

"Servo data provides a position error signal to maintain accurate read/write head tracking. Moving this data to another physical layer could free up more disk area for information storage and also enhance servo tracking, which could lead to higher track density," explains Chen.

The '2.5-dimensional' magnetic recording scheme demonstrated by Chen and his team uses a magnetic head with laser heating to allow non-information-carrying servo data to be written to and read from a second deep magnetic layer while maintaining the read/write performance required for normal data operations in the top layer.

"The main technical challenge we needed to overcome was writing to the bottom servo layer, which has been difficult due to the larger spacing between the servo layer and the write head," says Chen. "Laser heating lowers the magnetic coercivity, which allows the deeper bits to be switched using a relatively weak external magnetic field."

Using a heat assisted-magnetic recording system and multilayer disks

which the team fabricated, the researchers demonstrated that various servo bit densities and patterns could be achieved. With the potential to raise effective data density by up to 25 per cent, the dedicated deep servo layer approach is a promising advance for hard disk technology.

More information: Y. J. Chen et al. Heat assisted recording on bottom layer of dual recording layer perpendicular magnetic recording media for two and a half dimensional (2.5D) magnetic data storage, *Journal of Applied Physics* (2015). DOI: 10.1063/1.4907189

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