WHITE PAPER

AIT-5 DATA CARTRIDGE AND AME III TECHNOLOGY

Bridging Power and Performance

Presented By

SONY

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OVERVIEW

Sony's AIT™ technology, originally introduced in 1996, has now been extended to a fifth generation product called AIT-5. This new tape cartridge offers 400GB native/1.04TB compressed storage capacity while delivering backwards read-write compatibility up to the AIT-3 format. AIT-5 is the latest and uses the most advanced technology in the AIT Lineup (Chart 1).

AIT data cartridges are approximately one third the size of ½-inch format cartridges, such as LTO and DLT. When compared to LTO-3—even with the smaller physical size, 40% shorter tape length and 27% less tape area—AIT-5 is able to store the same amount of data thanks to a much greater areal density, which is approximately 5.8 times higher than that of LTO-3

Three new key technologies which enabled this extension to AIT-5 are as follows:

1. Dynamic tracking for both recording and retrieving data allows for even narrower track pitch
2. FG-GMR head (Flux Guide GMR) allows for output as high as +10dB, when compared with conventional inductive head
3. New AME III technology offers a higher SNR (Signal to Noise Ratio) due to a much finer Cobalt particle dispersion. Tape stability is also improved due to a new back-coating process.

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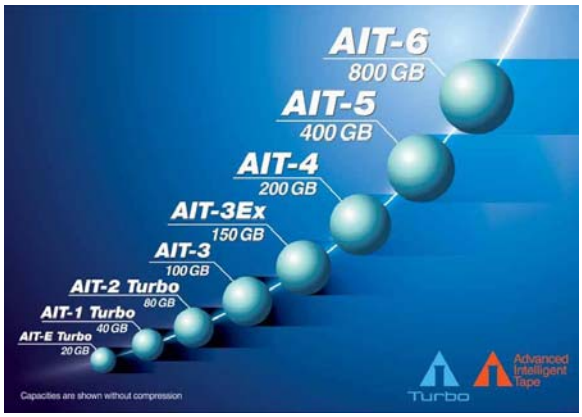

Chart 1: AIT format migration

A more detailed explanation is provided below regarding the three new key enabling technologies, all combined to offer the higher capacity and performance of AIT-5.

1. Dynamic tracking

Track pitch was reduced by half from 4.4um in AIT-4 to 2.2um, thus doubling the tape areal recording density from 1.172Gbit/inch^2 in AIT-4 to 2.344Gbit/inch^2 in AIT-5. While doubling the areal density also doubles the recording capacity, the negative impact is a SNR (Signal-to-Noise Ratio) that is reduced by 6dB (in theory) and ever more in actual tape usage, if no other technical counter-measurements are undertaken. To compensate for this potential SNR loss and even improve SNR, new Flux Guide GMR head was adopted in AIT-5 tape drive. This head improves SNR by 10dB, compared with Inductive head adopted for the AIT-4 tape drive. Thanks to its higher signal output and lower noise in AIT-5 tape, SNR in AIT-5 tape itself is improved by 1dB. With the combined improvements in the drive head and tape formulation, overall AIT-5 provides higher SNR by 3dB under tougher conditions due to narrower track pitch, compared with AIT-4, while realizing an even lower error rate.

2. FG-GMR head (Flux Guide GMR)

The world's first dynamic tracking head for data recording was adopted with AIT- 5. This enabled extremely precise recording in track pitch mentioned above. This head also minimizes the error in head pairing (i.e., head height adjustment on the tape drum, which levels error rate differences in each head channel).

More precise tracking was achieved by adopting new dynamic tracking head in data retrieval. This head is capable of tracking potential small change in track angle after years of tape usage, while achieving a lower error rate.

3. New AME III technology

Thanks to its adoption of finer Cobalt magnetic particles, the newest Advanced Metal Evaporated technology, AME III, provides higher signal output and lower noise, thus achieving higher SNR by 1dB, compared with AIT-4. Also adoption of new tape back coating formula secured higher reliability by a more stable running tape and minimized friction between head and tap, even after as many as 30,000 tape passes.

Finer Cobalt magnetic particles
For AIT-5 to pack as much data density into the same 8mm form factor, the size of the Cobalt magnetic particles had to be reduced. AME-III achieves a 60% reduction from 5~7nm in AIT-4 to 3~4nm in AIT-5 by developing of new Advanced Metal Evaporate method. (Fig.1)

These finer Cobalt magnetic particles were made possible by changing Cobalt evaporation angle and optimizing oxygen injection during evaporating process. Not only did this significantly reduce the size of the particles, but as mentioned before, it also improved the SNR by 1dB, when compared with AME II tape.

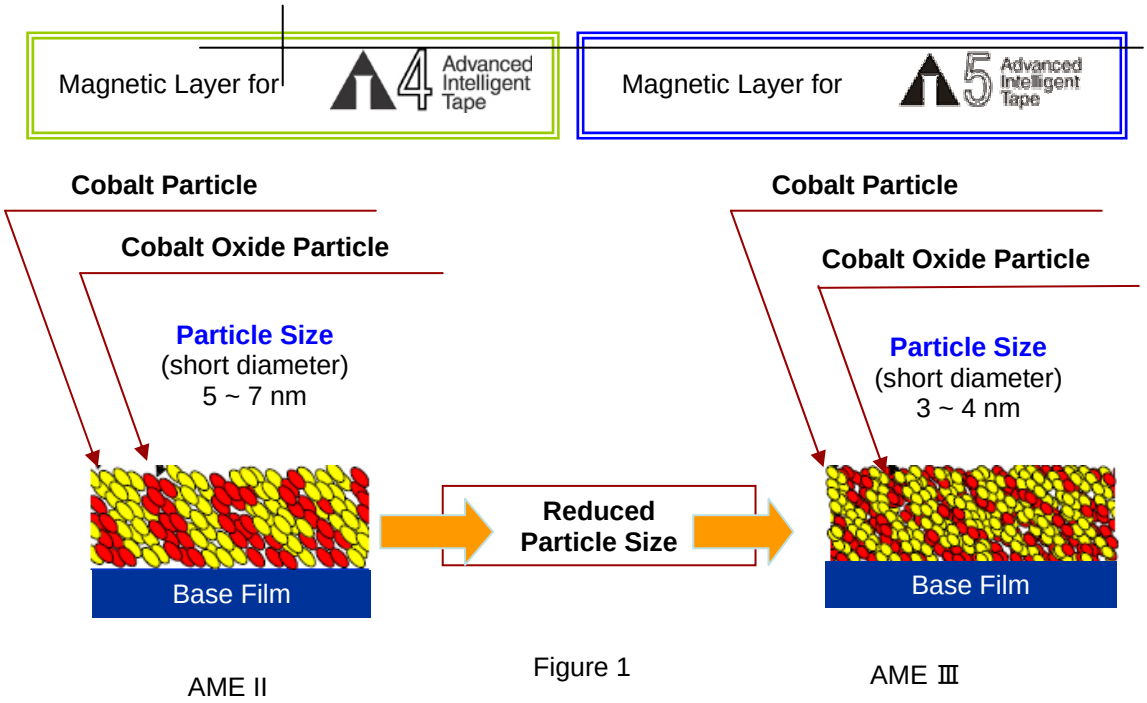

Figure 1

Figure 2 shows a 2T signal spectrums for AME I, AME II and AME II tape, measured with an AIT-5 tape drive. This clearly shows significantly lower noise and improved CNR (Carrier-to-Noise Ratio) for tape format using the AME III coating technology, as compared to the previous formulation. This lower noise was one of the key enablers allowing for higher SNR and better error rate, which was noted in section #2 above.

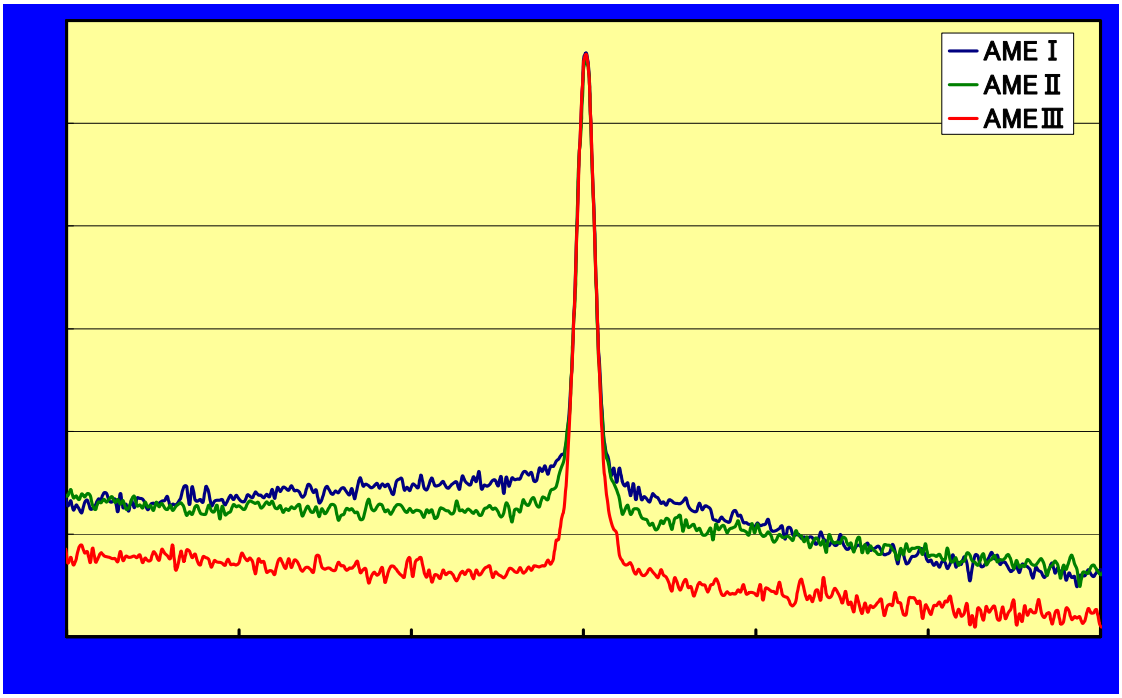

Figure 2

New tape back coating
Newly adopted back coating with a new additive provides lower friction with tape guide rollers in tape drive mechanism. (Figure 3)

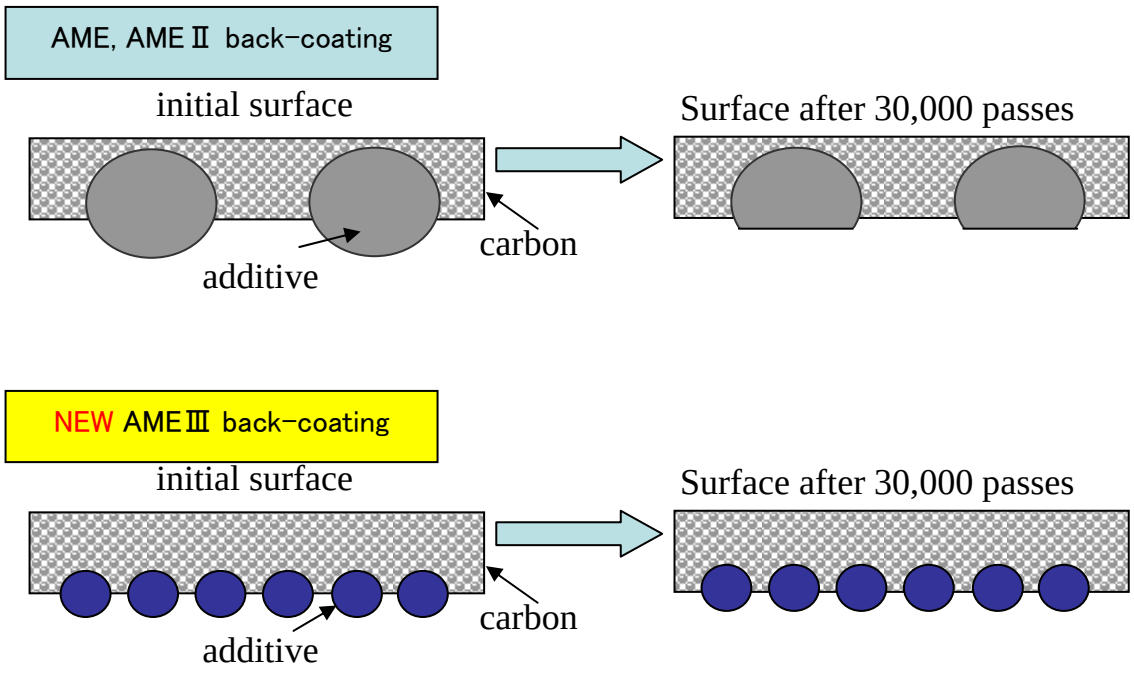

Figure 3

While the tape reliability of media coated with AME and AME II technology remains quite strong, the back-coat additives begin to get worn down after approximately 30,000 tape passes over the drive head. The new AME III back coating additives improve the tape stability, which can be seen by the diminished wear after 30,000 passes. This results in higher reliability in a longer period of use.

Fig.4 shows the friction coefficient to the back of the tape after a number of tape passes against the drive head. As shown, while the friction coefficient of AME and AME II are quite low, AME III maintains an even lower level of friction coefficient even after 30,000 passes and beyond, resulting in a very stable running environment.

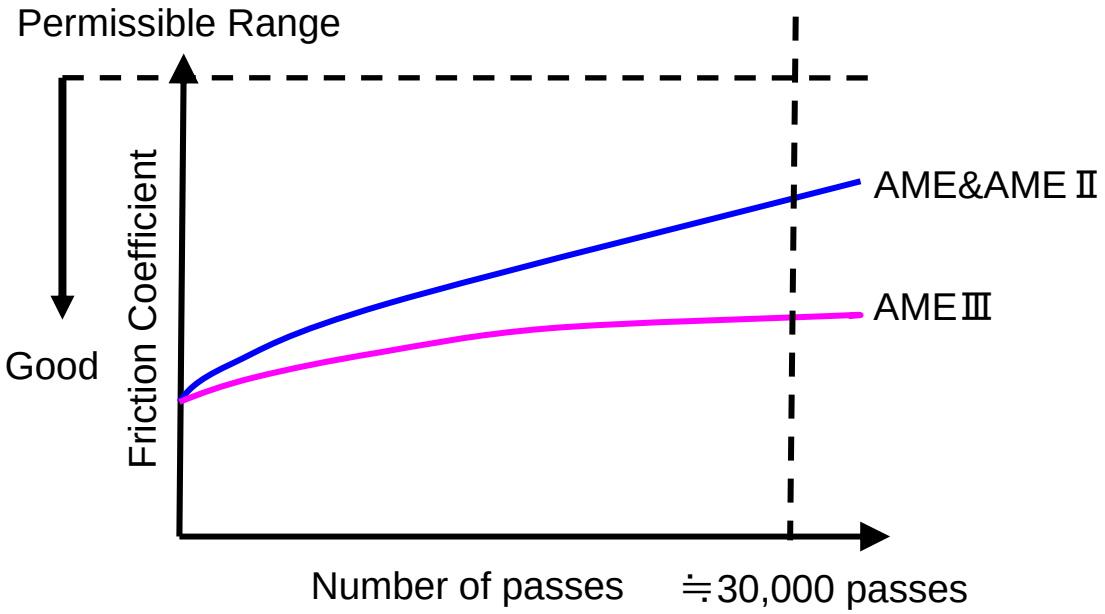

Figure 4

FUTURE OF AME MEDIA TECHNOLOGY

In January 2007, Sony publicly announced the achievement of an areal density of 23Gbit/inch^2 with a newer AME tape and GMR head. This is approximately 10 times more areal density than our current AME III technology offers. With this higher density of AME, there is a potential future AIT roadmap well beyond the currently announced AIT-6.

For more information, visit:

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