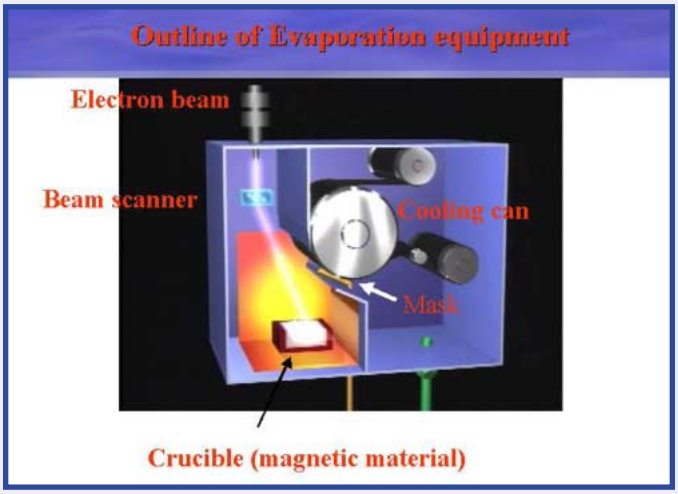
50 Years
Mastering Media Solutions

SONY PUTS THE PEDAL TO THE METAL WITH AME TAPE

Sony Advanced Metal Evaporated Technology Offers Higher Performance and Greater Capabilities for Consumer and Professional Data and Video Recording

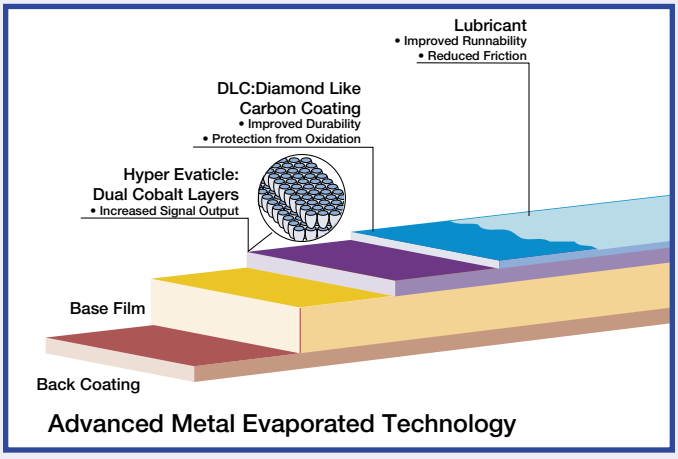
Sony and magnetic recording media are synonymous. In 1950, the company marketed the first magnetic recording tape in Japan, called Soni-Tape KA series, using paper-based tape. Fifty years later, Sony's Advanced Metal Evaporated (AME) technology is setting new standards in data recording and both professional and consumer video recording. AME tape's ability to offer the highest digital recording quality coupled with large amounts of data storage, long recording times and small cassette sizes has propelled its growth dramatically in both the professional and consumer marketplaces.



Sony introduced Metal Evaporated (ME) tape, the forerunner to AME tape, in 1989. It was first used in Sony Hi8 format video recording. Over the years, Sony has made improvements to the original ME tape that led to the introduction of the first-generation AME tapes in 1996 for data and video storage. A departure from traditional techniques, the evaporated metal technique was a breakthrough in increasing the capacity and durability of consumer and professional tape products.

AME: A Different Tape Paradigm

Conventional tape has a liquid magnetic layer that is applied to the base film with a glue-like binder. This result is that only about 40 to 50% of the coating is active magnetic material. By contrast, AME process uses a high-energy electron beam gun to vaporize pure magnetic cobalt metal in a vacuum chamber. This evaporated metal deposits directly on the base film without the need for an adhesive binder, creating a coating that is virtually 100% active magnetic material. Without the binder, AME tapes are thinner than those using older technologies, meaning more tape can fit into each cartridge. This is one



Advanced Metal Evaporated Technology

reason that cartridges of AME tape can hold so much recorded information.

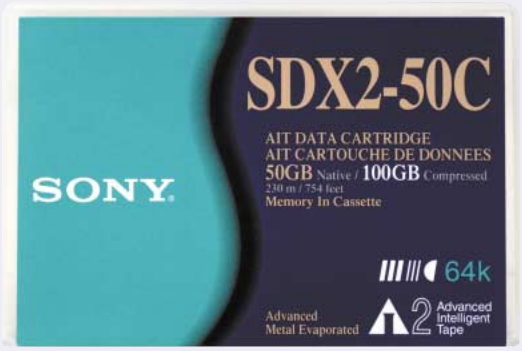
Steve Tice, general manager of the quality assurance and technical services department at Sony Magnetic Products of America's Dothan, Alabama, manufacturing facility, elaborates: "With AME, even the orientation angle on the individual evaporated grains is optimized to get the maximum transfer of energy into the magnetic layer and get the maximum signal out of the media. When you look at the physics of how this tape is made and how it works together with the recording equipment, it's actually as close as you can get to a perfect recording media as far as magnetic energy transfer - retaining that energy and playing it back."

Essentially, it all comes down to the wavelength being written to the tape. The goal is to get that wavelength as short as possible because the shorter the data interval, the more information the media can hold. And that's what AME makes possible. It's a tape that can record an extremely short wavelength, but yet have enough energy to read a healthy signal off the tape.

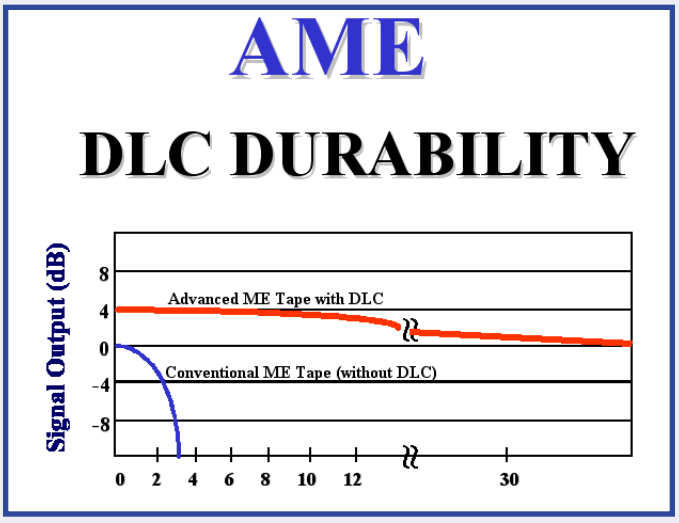
Part of the ability to read this signal comes from the use of pure cobalt magnetic material instead of the performance-sapping nickel alloys of earlier ME tape. Also, Sony uses a top-coating process called Diamond-Like Carbon (DLC). In the DLC coating process, the metal magnetic layer is protected with a very thin, flexible, crystallized carbon layer. This DLC layer is about 20 times harder than metal oxides (the material normally used to make grinding wheels) and on top of the smooth metal layer, makes the top surface even smoother. Together, the hardness and the smoothness of the DLC coating dramatically improves the tape durability and abrasion resistance, reduces the need for periodic cleaning, and increases the life of the drive recording heads.

AME Delivers Data Storage Benefits: Mammoth and AIT

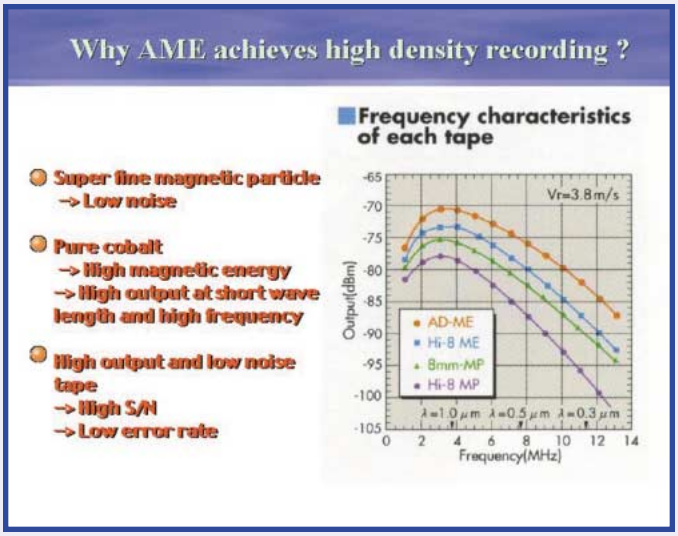
This combination of wear resistance and smoothness is ideal for recording tape; it resists wear and shedding, making the tapes and heads last longer, and requires cleaning less often, if at all. Drop-outs are essentially eliminated, and the tapes



give superb durability and archival stability, while producing higher playback signal output levels than metal particle tape. This is one of the reasons Sony's AME technology is at the heart of the Advanced Intelligent Tape (AIT) and Mammoth digital data storage



systems. Both these systems were designed to achieve the maximum user benefits of AME: compact size, high capacity and exceptional durability.

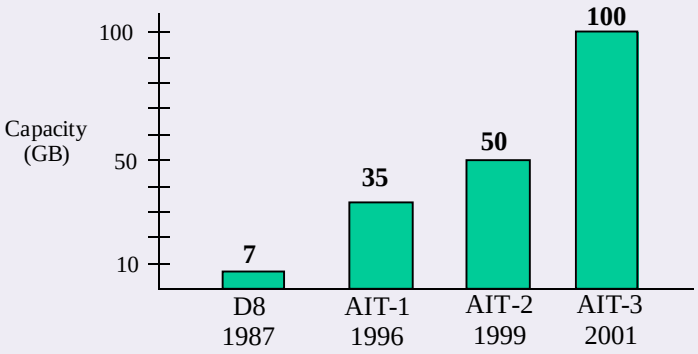


The Mammoth storage format is a trademark of Exabyte, and was developed in cooperation with Sony to use AME media. Like AIT, Mammoth tape cartridges are a two-spool, 8-millimeter design. Two generations of this format are currently available, Mammoth-1 and Mammoth-2. Sony continues to manufacture Mammoth tapes using the AME process and supports this important data storage format.

Sony introduced the AIT format in 1996. AIT-1 tapes not only held a large amount of information in a small size (up to 35GB in an 8-millimeter cartridge), but offered unparalleled performance in many factors. One key feature of the AIT format that helps it realize the potential of the AME tape is the inclusion of a memory chip in the cassette, called the Memory-in-Cassette (MIC) chip, that could be read instantly by the AIT drive. This chip holds the ID number of the cassette, file directory, and other performance information, enabling proactive storage management and speeding access times, among other things.

Since 1996, Sony has introduced two more generations of AIT data storage systems and media—AIT-2 and AIT-3. Now, all three generations of drives and media, which are backward compatible, are available to match a range of user needs. From the entry-level AIT-1 (35 GB native, 4 MB/second transfer rate), through the workhorse AIT-2 (50 GB, 6 MB/sec.) models, and up to the most recent and powerful AIT-3 (100 GB, 12 MB/sec.), which is ideal for large-volume network backup, video editing and video on demand, the AIT systems build on the capabilities of the AME technology, delivering high performance in a small footprint at an attractive price.

Reviewing the history and the future roadmap of AIT in the chart below shows how AME media is critical to the performance of the format. The AIT and Mammoth formats both evolved from the D8 data cartridge format that uses metal particle media. Comparing the AME and the metal particle tapes shows that one D8 metal particle cartridge can store up to 7 GB uncompressed, while AIT will store from 35 up to 100 GB native.

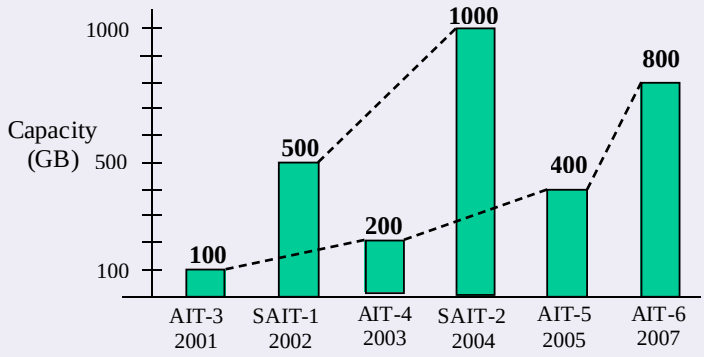


Expanding the Technology: The SAIT Format

Looking beyond 2001, however, is where the potential of AME media really shines. Over the last several years, Sony engineers have broken records for recording densities in a laboratory setting. While these achievements are not yet commercially viable, Sony has proved that its AIT roadmap can be achieved with Sony technology.

In addition to the AIT roadmap (included in the chart below,) Sony has announced a new data storage format that uses the same AME media material as AIT and the same recording head technology, but packages the tape in a one-spool, half-inch format that is similar in physical size to DLT and LTO tape formats. (Recall that the AIT format uses a compact, two-spool 8mm cassette). This new format is called SAIT. Because the tape is about five times the surface area of the 8mm AIT tape, each SAIT tape cartridge can hold about five times the information.

Why would Sony offer both AIT and SAIT? For that matter, why does Sony offer the other 16 data formats too? The answer to both questions is simple: Customers have a variety of needs, and value the different qualities of each data storage format differently. While at first glance AIT and SAIT are very similar (the same media formulation, the same recording heads, etc.), the difference between a single-spool design and a two-spool design is dramatic. The two-spool design will load, seek and unload faster than the one-spool design. The one-spool design trades access speed for raw capacity. So, the more interactive the storage needs are (for example, pulling up statistics to support a baseball 'color' commentator), the more likely the two-spool design of AIT would be appropriate because of its faster access time. Conversely, backing up centralized shared drives would require the SAIT format's ability to pack huge amounts of data into the smallest possible space.



As the chart shows, AIT's capacity will continue doubling approximately every two years, achieving 800 GB native capacity per 8mm cartridge before the end of the decade. As with all AIT systems, the built-in ALDC compression will compress amenable data at least by a factor of 2.6. The laboratory demonstrations that have been announced as recently as May 1, 2002, prove that the 8mm AIT format can eventually hold 2 terabytes (TB), or 2000 GB, of native data. By that prediction, SAIT will eventually be able to hold 10 TB in a single cartridge! And this is not just a wishful prediction — this is a concrete, achievable plan that is already corroborated by laboratory demonstrations using today's Sony AME technology.

Increased American Production For AIT

To meet the increasing market demands for Sony's AIT and SAIT data storage media, Sony Magnetic Products of America (SMPA), a manufacturing unit of Sony Electronics Inc., invested $34 million in 2000 to increase AME tape production capacity at its Dothan, Alabama, facility. The first shipment of AIT-2 tapes from SMPA took place in July 2001 as part of a major expansion effort to meet the growing demand of high-capacity, metal/digital tape products. The Dothan facility is currently shipping AIT-3 media and preparing for the coming release of AIT-4 systems.

"Increasing production in the U.S. helps us offer our customers the expanded distribution needed to address the growing market demand," said Tom Evans, Vice President of the Media Solutions Company of Sony Electronics, Inc. "Sony anticipates a continuing growth in the AME media market as the acceptance, and embedded base of AIT and SAIT systems grow."

Expanding the AIT and SAIT production capacity in the U.S. is a natural expansion of the Dothan facility, complementing Sony's existing AME production of Hi 8, Mini DV and DVCAM videotapes. This start-up will result in shorter lead-times to ensure faster delivery to customers and greater overall production flexibility. The Dothan facility produces data storage products, consumer and professional videotape and audio tape.

Making the Most of Video Applications

In addition to Sony's Mammoth, AIT and SAIT data recording applications, AME is used to produce tapes for Sony's DVCAM professional format and the DV consumer video systems. AME was originally developed for use in Hi8 video applications and now is used for the 8mm DARS (digital professional audio), Digital Mini DV (designed for digital consumer video) and DVCAM (digital professional video) formats. AME technology is used in both professional and consumer formats because of the format requirements to record a very high frequency signal and also the associated benefit of a very small cassette.

Consumer acceptance of DV with its AME tape has been dramatic; Sony estimates the total U.S. DV tape market to continue to grow as the ability of home users to capture, edit, send, and share their creations is made even easier and less costly. End-users can transfer digital video from DVCAM or a DV camera, edit, store it as an MPEG file and e-mail it to anyone. And because it's digital, there is no degradation of quality between generations.

To meet the demanding needs of professional users, durability, extremely low head wear and cost-effectiveness are all qualities that AME brings to the table. Because DVCAM tapes can be used in harsh environments with multiple edits and field production

editing, it was specifically engineered with the professional user in mind. It is designed to withstand these rigors with its DLC protective layer over the magnetic layer ensuring professional-level durability and a specially treated base film to preserve tracking integrity, while its 16 Kbit chip (when used with compatible hardware) makes it fast and easy to locate material on the tape. DVCAM tape also has lower error rates and more consistent physical characteristics than the Mini DV tape.

The DVCAM format captures up to three hours of digital component video on a standard cassette not much larger than an 8mm videotape. It calls for high bandwidth and narrow track width. Meeting both of these targets - without compromising reliability - necessitated a high output tape, a demand met by AME. Combined, these factors result in a powerful package for the user.

From broadcast to production event videography to webcasting, the benefits of AME have been widely embraced as shown by the format's rapid growth.