-- Its Benefits and Applications --

Fujifilm ATOMM Technology Seminar
March 10, 2008
Developments in Ultra Thin-Coated Media

Fujifilm ATOMM Technology

Advanced super Thin-layer and high-Output Metal Media
ATOMM TAPE TECHNOLOGY

Ultrathin magnetic layer with double layer structure

Standard MP

ATOMM

Advantages of ATOMM

- Higher Output at Short Wavelength
- Lower Noise - Smoother Surface
- Superior Running Durability
- More Environmentally Stable
- Mass Production
ATOMM-DISK has an 8db higher signal output than conventional floppy disks at 50 Kftpi.
A thinner magnetic layer creates a stronger magnetic signal at higher densities (short wavelength signals).

Coating thicknesses beyond a thickness equal to 1/4 to 1/3 of the recording wavelength (bit length) reduces the magnetic signal through the demagnetization effect.

**Weak demagnetizing force**
A sewing needle easily becomes a strong magnet:

**Strong demagnetizing force**
A steel ball is not easily magnetized:
Smoother Surface of ATOMM Technology

Thin layer MP
(ATOMM Media)

Conventional MP
Superior Wear Resistance

ATOMM's Smoother Surface ➔ More stable clean running performance.

Fujifilm's High Molecular Weight Binder with Advanced Stability ➔ Resists time fatigue and environmental effects.

ATOMM's Better Lubricant Replenishment ➔ Lubricant optimization in both layers with lower-layer reservoir function for longer lasting protection.

ATOMM's Lower-Layer Cushioning Function ➔ Better head-to-media contact and durability.
Storage reliability of ATOMM

Loss of Magnetization(%) vs Exposure period at 60C 90%RH (days)

- Single layer
- ATOMM
ATOMM - TECHNOLOGY

Performance Benefits

• **High Capacity** - Achievable by Upper Layer with Dual Coating

• **High Output** - Attributable to Thin Magnetic Upper Layer

• **Excellent Durability** - Attributable to MP with Titan-Fine Lower Layer

• **Better Archival Life** - Attributable to Thin Magnetic Layer
Fujifilm began coating motion picture and photographic film in the mid 1930's using die coating technology. In 1960 simultaneous multi-coating technology was developed. Also in 1960, Fujifilm produced its first magnetic tape products. In 1965, Fujifilm began manufacturing computer tape. Fujifilm's computer floppy disks were introduced in 1977. Fujifilm began manufacturing dual-coated magnetic media in 1989 and ATOMM dual-coated media in 1992. For ATOMM, Fujifilm's special die coating head applies two separate formulation layers at different depths and thicknesses simultaneously.
Coating Technologies

Reverse Roll Coating
- Metering Roll
- Applicator Roll
- Basefilm Web
- Backing Roll
- Coated Media

Slot Die Coating
- Slot Die
- Coated Media
- Basefilm Web

Metal Evaporated Coating
- Electron Beam
- Cooling Drum
- Guide
- Crucible
- Molten Metal Alloy
- Evaporated Metal
- VACUUM CHAMBER
- Coated Media
- Basefilm Web
AME Media Structure*

- Lubricant
- Carbon layer
- 2nd magnetic layer
- 1st magnetic layer
- Undercoat layer
- Substrate
- Back coat layer

*Not to Scale
ATOMM Media Structure*

- High coercivity magnetic layer, with lubricants
- Non-magnetic under layer, with lubricants
- Enhanced base film
- Back coat layer

*Not to Scale
Fujifilm has always employed the die-coating manufacturing process!

Fujifilm Developed the Simultaneous Dual-Coating Process Technology Using a Die-Coating Method.
Ultrathin magnetic layer with double layer structure
Ultra-thin magnetic layer with double layer structure, coated on both sides of the base film material:
All Fujifilm Metal Particle (MP) Media is Designed for Minimum Errors and Maximum Durability:

◆ Coating Processes
  - Superior Die Coating
  - Super-calendering
  - Optimized for Each Technology

◆ Advance Superfine Metallic Particles
  - High Signal Strength (Output)
  - Better Data Reliability (Lower Errors)
  - Optimized for Each Technology

◆ Ultra-Stabilizing Particle Overcoat
  - Stable Signal Retention
  - Longer Data Retention (Archival Life)

◆ 3-D Network Binder System
  - Resist Time Fatigue (Long Archival Life)
  - Exceptional Wear Resistance (Durability)
  - Clean Running (No Head Clogging)

◆ Solid & Liquid Lubrication System
  - Optimized for Each Technology
  - Reduced Tape and Head Wear
  - Superior Runnability & Durability

◆ SDR Anti-Static Backcoating
  *Applicable to Tape Media Only!
  - Guards Against Dust & Debris Attraction
  - Stable/Precise Clean-Running
Application of ATOMM Media

CONSUMER USE

Hi-8MEP
W-VHS

DVCPro
Digital-S (D9)
PRO-Hi8MEP
DTRS

BROADCASTING USE

ATOMM

ZIP-100 disk
DLTtape IV
DDS3 4mm
DDS4 4mm
HiFD disk
Zip-250 disk
LTO Ultrium 1
SuperDLTtape I
Zip-750 disk
LTO Ultrium 2
DTF-2
DAT-72
LTO Ultrium 3
SuperDLTtape II
DLTtape S4

COMPUTER USE
Application of **ATOMM** Technology

1992: World's First ME Position Hi-8 MP Video Tape
1993: World's First Hi-Definition Video Tape (W-VHS)
1994: ATOMM-DISK Technology Announced
1994: First ATOMM Computer Tape (DLTtapeIV)
1995: First ATOMM Computer Disk (ZIP) 100MB
1996: First Professional Video Tape (DVCPRO)
1996: Fujifilm Data 8mm Tape Renewed by Dual-Coating
1996: Fujifilm ATOMM DDS3 (4mm - 125m)
1999: HiFD 200 MB 3.5" Floppies
1999: ZIP-250 Disk
1999: Fujifilm ATOMM DDS4 (4mm - 150m)
2000: LTO Ultrium 1 100 Gigabyte Data Cartridge
2001: SuperDLTtape I 160 Gigabyte Data Cartridge
2002: Zip-750 Disk
2002: LTO Ultrium 2 200 Gigabyte Data Cartridge
2003: DTF-2 200 GB Large Cartridge
2003: DAT-72 36 GB 5th Generation DDS Data Cartridge
2004: LTO Ultrium 3 400 Gigabyte Data Cartridge
2005: SuperDLTtape II 300 Gigabyte Data Cartridge
2006: DLTtape S4 - 800 Gigabyte Data Cartridge
## Tape & Disk Drives – Using ATOMM Media

<table>
<thead>
<tr>
<th>Drive System</th>
<th>Tape Media</th>
<th>Native Capacity</th>
<th>Native Data Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>DLT S4</td>
<td>DLTtape S4</td>
<td>800 GB</td>
<td>60 MB/s</td>
</tr>
<tr>
<td>LTO Ultrium 3</td>
<td>LTO Ultrium 3</td>
<td>400 GB</td>
<td>68 – 80 MB/s</td>
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<tr>
<td>SDLT-600</td>
<td>SuperDLTtapeII</td>
<td>300 GB</td>
<td>36 MB/s</td>
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<tr>
<td>DTF-2</td>
<td>DTF-2</td>
<td>200 GB</td>
<td>24 MB/s</td>
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<tr>
<td>LTO Ultrium 2</td>
<td>LTO Ultrium 2</td>
<td>200 GB</td>
<td>20 – 40 MB/s</td>
</tr>
<tr>
<td>LTO Ultrium 1</td>
<td>LTO Ultrium 1</td>
<td>100 GB</td>
<td>7.5 – 20 MB/s</td>
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<tr>
<td>SDLT-320</td>
<td>SuperDLTtape</td>
<td>160 GB</td>
<td>16 MB/s</td>
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<tr>
<td>SDLT-220</td>
<td>SuperDLTtape</td>
<td>110 GB</td>
<td>11 MB/s</td>
</tr>
<tr>
<td>DLT1 &amp; VS80</td>
<td>DLTtape IV</td>
<td>40 GB</td>
<td>3 MB/s</td>
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<tr>
<td>DLT 8000</td>
<td>DLTtape IV</td>
<td>40 GB</td>
<td>6 MB/s</td>
</tr>
<tr>
<td>DAT-72</td>
<td>DAT-72 170M</td>
<td>36 GB</td>
<td>3.5 MB/s</td>
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<tr>
<td>DLT 7000</td>
<td>DLTtape IV</td>
<td>35 GB</td>
<td>5 MB/s</td>
</tr>
<tr>
<td>DLT 4000</td>
<td>DLTtape IV</td>
<td>20 GB</td>
<td>1.5 MB/s</td>
</tr>
<tr>
<td>DDS4 4mm</td>
<td>150M</td>
<td>20 GB</td>
<td>2.4 – 3 MB/s</td>
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<tr>
<td>DDS3 4mm</td>
<td>125M</td>
<td>12 GB</td>
<td>1.0 – 1.5 MB/s</td>
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<tr>
<td>D8 EXB8505 XL</td>
<td>QG-160M*</td>
<td>7 GB</td>
<td>0.5 MB/s</td>
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<tr>
<td>D8 EXB8505</td>
<td>QG-112M*</td>
<td>5 GB</td>
<td>0.5 MB/s</td>
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<tr>
<td>Bernoulli™230</td>
<td>5 ¼” Disk**</td>
<td>230 MB</td>
<td>2.7 MB/s</td>
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<tr>
<td>HiFD</td>
<td>3.5” Disk</td>
<td>200 MB</td>
<td>3.6 MB/s</td>
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<tr>
<td>Zip 750</td>
<td>3.7” Disk</td>
<td>750 MB</td>
<td>7 MB/s</td>
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<tr>
<td>Zip 250</td>
<td>3.7” Disk</td>
<td>250 MB</td>
<td>1.7 MB/s</td>
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<tr>
<td>Zip 100</td>
<td>3.7” Disk</td>
<td>100 MB</td>
<td>1.4 MB/s</td>
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</tbody>
</table>
ATOMM APPLICATIONS

- Advanced MP Tape
- DDS3
- DDS4
- LTO Ultrium 1
- Super DLT tape I
- LTO Ultrium 2
- DTF-2
- DAT-72
- LTO Ultrium 3
- Super DLT tape II
- DLTtape S4

- High Density Diskette
  - Zip-100
  - HiFD
  - Zip-250
  - Zip-750

- DLTtape IV
  - Improved D8

- DLTtape III
  - DDS1 & DDS2
  - D8
Think Fujifilm Media, for Today’s & Tomorrow’s Most Popular Drives!

Thank You!

Advanced super Thin-layer and high-output Metal Media

nanocubic
FUJIFILM RECORDING MEDIA
Fujifilm’s Coating Technology Creates Breakthrough Products

Fujifilm began coating motion picture and photographic film in the mid 1930’s using die coating technology. Simultaneous multi-coating technology was developed in 1960. Also in 1960, Fujifilm produced its first magnetic tape products. In 1965, Fujifilm began manufacturing computer tape. Fujifilm’s floppy disks (8-inch) were introduced in 1977. Fujifilm began manufacturing dual-coated magnetic media in 1989 and Advanced super Thin-layer and high-Output Metal Media (ATOMM) dual-coated media in 1992. For ATOMM, Fujifilm’s special die coating head simultaneously applies two separate and unique layers, one magnetic and one non-magnetic. It’s a dual coating system Fujifilm invented that has allowed us to continually develop the industry’s “next generation” storage products and develop nanocubic™ Technology for data storage products with even greater capacities.