

## Physical Properties of Film & Video

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<http://www.tisch.nyu.edu/preservation>

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## We're always reformatting, and dealing with wide variety of formats

- Nitrate
- Super8
- Cinemascope
- 3-D
- Cartridge
- ...

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## Technical Composition & Deterioration-

- Film
- Video and Audio Tapes

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## Film Layers

Image Permanance Institute



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## Film Layers

ScreenSound Film Preservation Handbook



- Topcoat
- Emulsion (content)
- Subbing Layer (adhere)
- Base (cellulose triacetate, cellulose diacetate, cellulose nitrate, or polyester)
- Backing Layer

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## Surface Physical Damage

- Perforation
- Scratches
- Water droplet damage to emulsion

• ScreenSound Film Preservation Handbook



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## Mold Damage

ScreenSound Film Preservation Handbook

- Usually in gelatin part of emulsion layer
- Interesting patterns



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## Shrinkage

ScreenSound Film Preservation Handbook



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## Vinegar Syndrome Deterioration

Image Permanence Institute



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## Signs of Vinegar Syndrome

- sour smell
- Shrinkage
- buckling of the emulsion
- the appearance of crystals that obscure the image

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## Film--Acetate Decomposition

cupping--Home Film Preservation Guide--filmforever.org



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## Film--Acetate Decomposition

emulsion cracks--Home Film Preservation Guide--filmforever.org



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## IPI A-D Strips



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## Acid Detection Strips at NYU Library



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## NYU University Archives Internship Project Acid Detection results/autocatalytic point readings

University Archives Collections	Total # of items	0 - 1.0	% of 0 - 1.0	1.5 - 3.0	% of 1.5 - 3.0
University Archives (in total)	400	325	81%	75	19%
Audio Visual	107	82	77%	25	23%
Brademas Papers	75	75	100%	0	0%
Classics Dept. Tapes	101	100	99%	1	1%
Dept. of Athletics	14	4	29%	10	71%
External Affairs	2	2	100%	0	0%
Abby Weed Grey	37	37	100%	0	0%
Alice V. Kellher	10	10	100%	0	0%
Miscellaneous Films	45	6	13%	39	87%
Annette Weiner	9	9	100%	0	0%

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## IPI Storage Guide



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## IPI Media Storage Reference Guide



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## IPI Preservation Index

temperature/humidity, Years until noticeable deterioration

% RH	Temperature C°						
	2°	7°	13°	18°	24°	29°	35°
20	1250	600	250	125	60	30	16
30	900	400	200	90	45	25	12
40	700	300	150	70	35	18	10
50	500	250	100	50	25	14	7
60	350	175	80	40	20	11	6
70	250	125	60	30	16	9	5
80	200	100	50	25	13	7	4

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## Improving storage inside the Can

Jean-Louis Bigourdan, AMIA 1998

- zeolites, silica gel, and low relative humidity preconditioning help mostly by reducing moisture content
- acid adsorbents retard further decay
- acid adsorbents do not reduce the acid content of degraded film
- the use of cardboard disks is not recommended

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## Improving storage outside the Can

Jean-Louis Bigourdan, AMIA 1998

- lowering temperature and/or relative humidity can help reduce the rate of acidification in degrading film
- trying to remove acid within the can does not outweigh the benefits of low temperature and humidity
- the greatest improvements in chemical stability can be achieved with cold temperatures

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## Cineric Film Restoration (Internship)

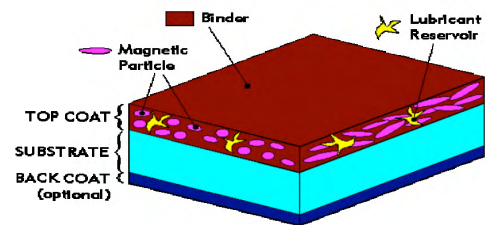


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## Structure of Tape

Van Bogart <http://www.cllr.org/pubs/reports/pub54>



- Binder-Functions as a carrier for the recording material & Bonds it to the substrate
- Substrate-Base material on which the recording material is coated (eg. an aluminum platter or a thin ribbon of polyester film)

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## Tape Substrate

- Early tape used cellulose acetate
  - Moisture/hydrolysis
  - Vinegar syndrome
- More recent tapes are polyester terephthalate (PET) or polyethylene naphthalate (PEN)
  - Chemically stable
  - Resist hydrolysis and oxidation

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## Magnetic Particles

- Store recorded information
- Change in magnetic properties can result in loss
  - ♦ Magnetic remanence - ability to retain a magnetic field
  - ♦ Coercivity - ability to resist demagnetization
  - ♦ Magnetic deterioration of the metal particulate and chromium dioxide materials

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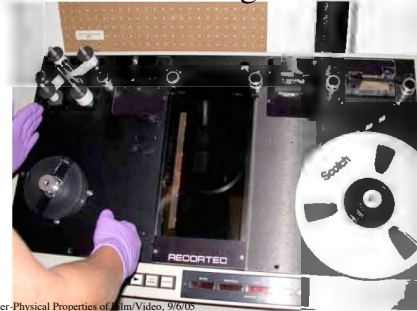
## Binder Layer

- Holds the magnetic particles to the base
- Where the problems are likely to occur
  - ♦ binder-base adhesion
  - ♦ oxide shedding
  - ♦ dropoff
  - ♦ hydrolysis
    - sticky shed
    - magnetic head clog
- Tape baking as one solution

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## Video Cleaning Machine

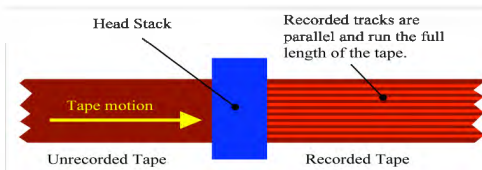


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## Longitudinal Recording

Van Bogart <http://www.cllr.org/pubs/reports/pub54>

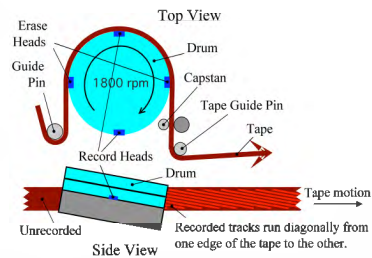


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## Helical Scan Recording

Van Bogart <http://www.cllr.org/pubs/reports/pub54>

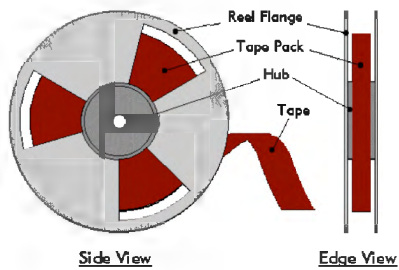


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## Tape Pack Problems

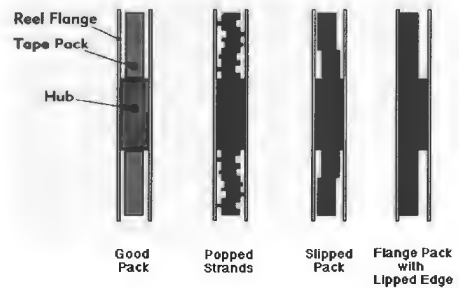
Van Bogart <http://www.cllr.org/pubs/reports/pub54>



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## Tape Pack Problems

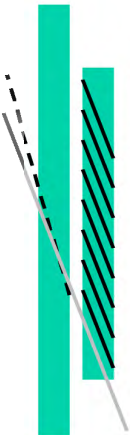


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## Packing problems can lead to playback problems

- Tracks for helical scan can be skewed



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## Storing Tapes

- Tapes should be stored fully wound in one direction or the other
- Store tapes upright (like a book)
- Do not store near potential magnetic fields
- Storage cases should be opaque and kept away from source of light and humidity
- Do not store tapes in plastic bags
- Exercise the tape every few years

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## Temperature & Humidity for Tape Storage

- Variance of less than 2°C and 5% RH per 24 hours
- Ideally 8°C and 25% RH
- Other options
  - 20°C (68°F) and 20-30% RH
  - 15°C (59°F) and 20-40% RH
  - 10°C (50°F) and 20-50% RH
- Never store below 8°C

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amiamer.org 2003, & ISO 18923

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## VidPax Video Preservation



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## What can you do now?

For both Film & Video

- Label elements as well as you can
- Try to keep things at a low humidity and temperature
- Limit the number of formats as much as possible
- Save important production elements

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## Be concerned about ©

- For preservation you may need to re-format, but with recent changes in copyright laws, you may not have the right to re-format
- Intellectual property rights are very difficult, particularly considering that most films and videos have extensive underlying rights that you could never get prior permission for (stock footage, historical footage, music composition, music performance, ...) ["Eyes on the Prize"]
- And even if you have the right to re-format for preservation, you might not have the right to show what you have preserved

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- <http://www.amianet.org/>
- <http://sunsite.berkeley.edu/Longevity/>
- <http://www.imagepermanenceinstitute.org/>
- <http://www.screenound.gov.au/screenound/screenso.nsf/>