

Rapid Non-destructive Identification of Degraded Magnetic Tape

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Preservation Research and Testing Division



THE NEED

Cultural Heritage Index (U.S.)

- 46 million tapes
(reel to reel, VHS, DAT, cassette, etc.)
- >40% in unknown condition

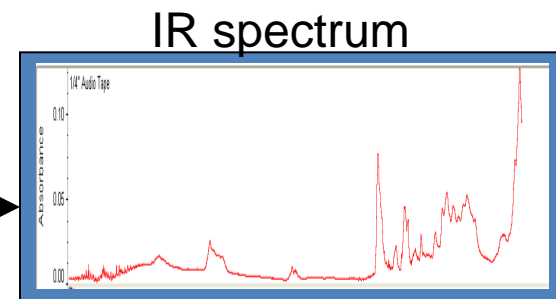
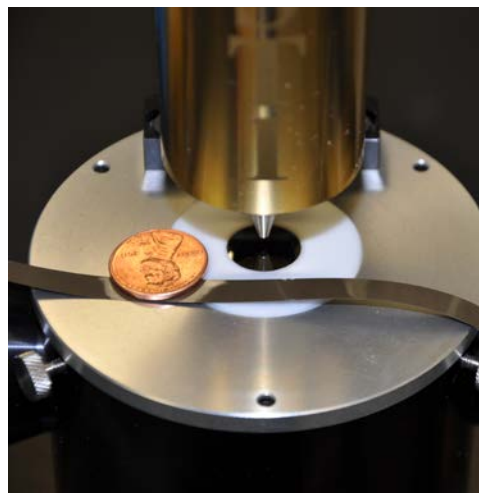
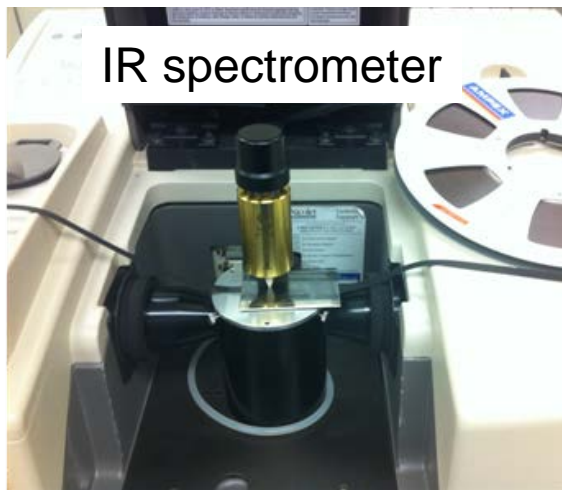
Current evaluation methods:

- Visual inspection
- Playing (potentially destructive)
- If the tape squeals, flakes, breaks, or sticks to playback equipment, it is removed and treated. This process may render the playback device unusable until it is cleaned and can permanently damage the tape, which leads to loss of data.



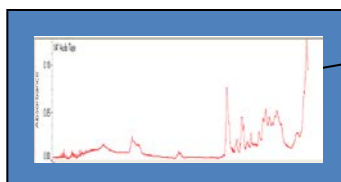
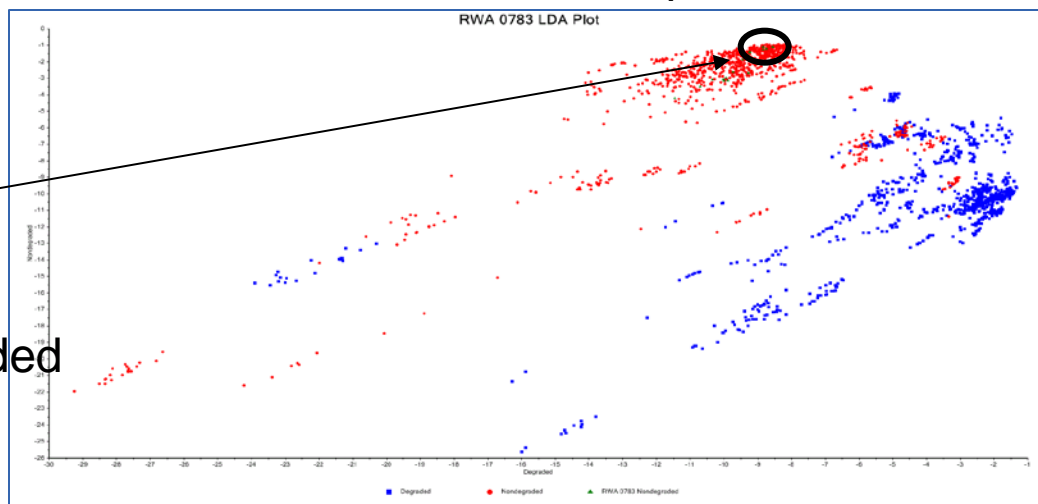
A reliable, non-destructive identification system is not available

Spectroscopic system for differentiating degraded and non-degraded tapes:



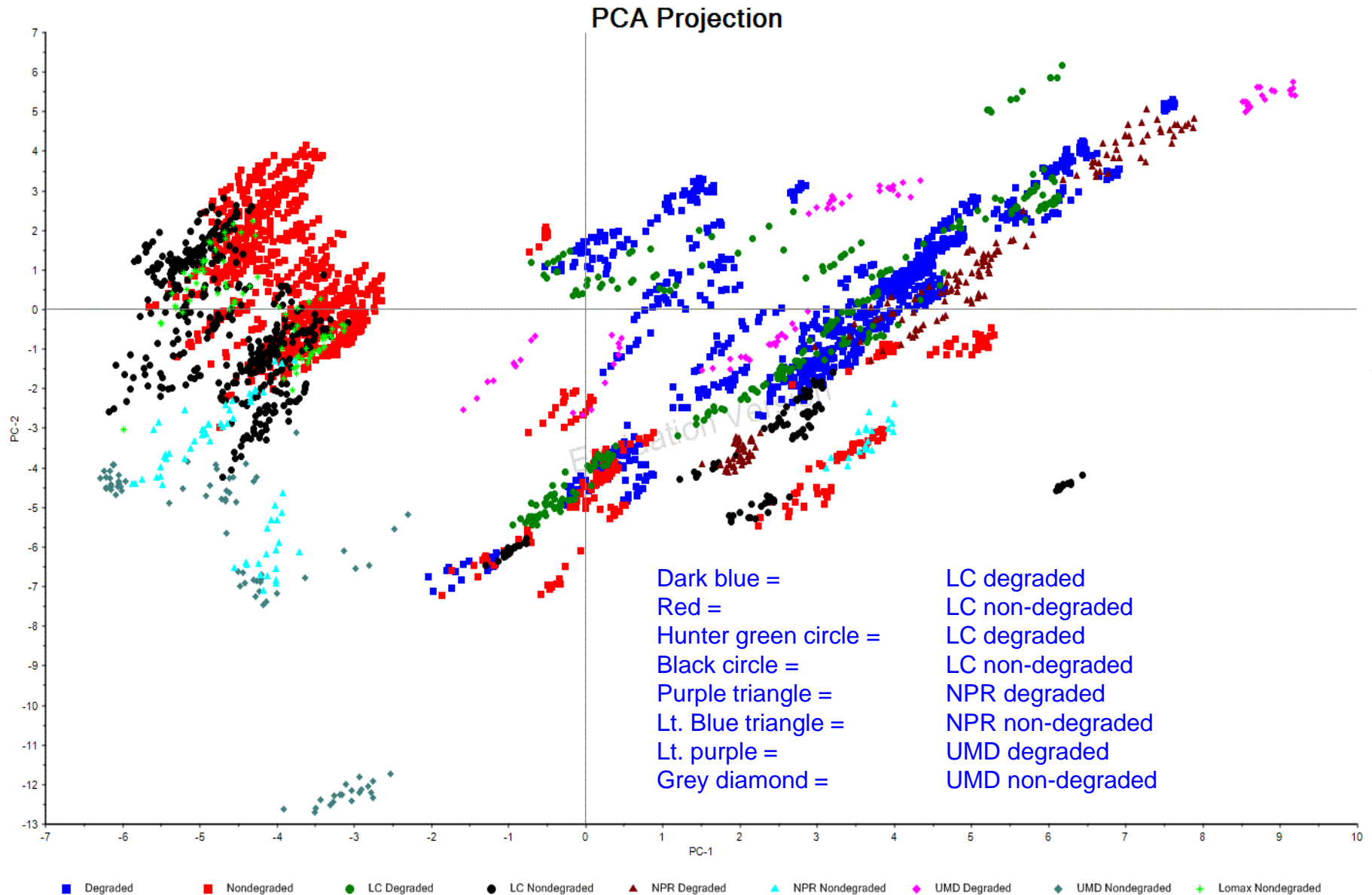
↓
Chemo-
metrics

Chemometric output



Classification as non-degraded

Chemometric analysis of tapes in unknown condition vs. known LC collection tapes:



How well does the system work for identifying degradation state?

Model: 94 tapes 1880 spectra 44D/50ND

Test Sets:

LC: 40 tapes 800 spectra 92.38%

UMD: 8 tapes 160 spectra 80D/80ND 97.5%

NPR: 12 tapes 240 spectra 160D/80ND 100%

Lomax: 4 tapes 78 spectra 78ND 100%

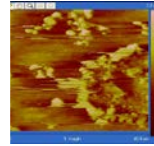
All data:

94.91%

Classifies well on both LC and non-LC collections!

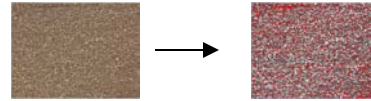
Summary

-Differences in surface roughness identified



-Small circular surface features identified on degraded

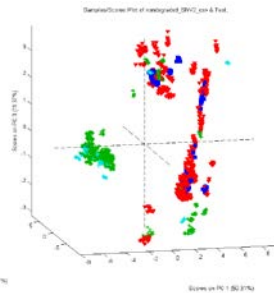
- Quantification underway



- Possibly useful for inexpensive non-contact identification

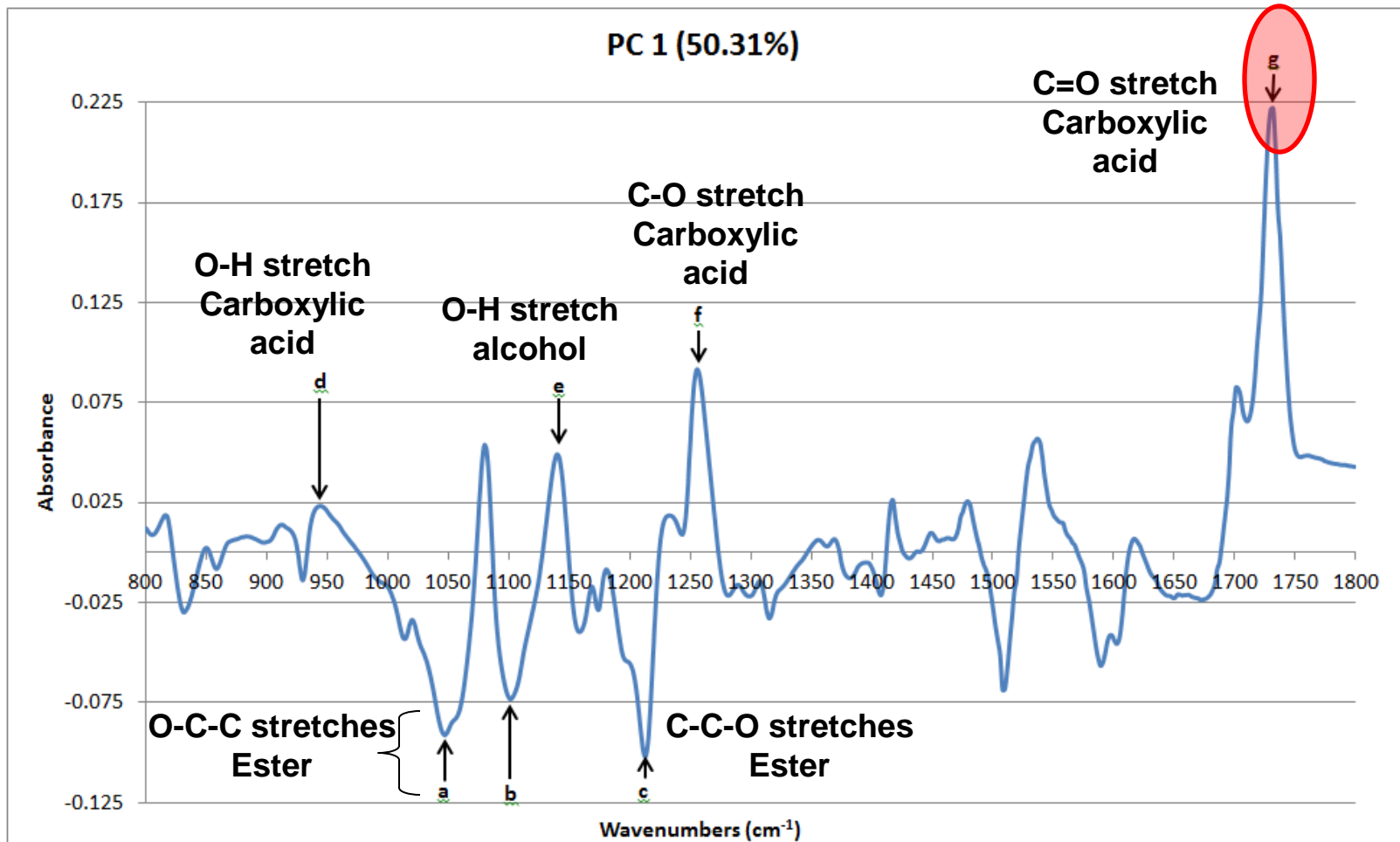
- Confirmed presence of adipic acid in degraded tapes via GC/MS

- Chemometric analysis of IR data allows excellent categorization of both LC and non-LC 1/4" tapes!



Next steps are to evaluate non- 1/4" formats.

What types of compounds allow the chemometrics to differentiate tapes?



**Degraded dominated by alcohols and acids.
Non-degraded dominated by esters.**