

Testing the Bond: A Study of Stickers on Contemporary Artwork

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Introduction

- Research must be done to determine the long-term effects of stickers on their support.
- Deterioration could occur, such as yellowing and brittleness, for both the support and the sticker itself.
- This research study focused on observing the possible deterioration between the stickers and the support.
- Numerous tests were performed on unaged and aged replicas.



Experimental

Material:

- Self-adhering labels on top of the following substrates:
Silver gelatin print, Canson and Strathmore papers
- Sample Preparation: exposure to: 65% relative humidity and 80°C for 28 days.



Group A	Unaged label on photo (Control)
Group B	Aged label on photo
Group C	Unaged label on Canson paper(Control)
Group D	Aged label on Canson paper
Group E	Unaged label on Strathmore paper (Control)
Group F	Aged label on Strathmore paper

Method:

- Visual Assessment:** yellowness, brittleness and delamination.
- Removability:** mechanical removal of labels, different percentages assigned.
- Fourier Transform Infrared (FTIR) spectroscopy** analysed stickers, labels and unaged and aged samples
- Photographic Activity Test (PAT)** at the Image Permanence Institute (IPI), Rochester, NY. The samples were placed in a humidity cabinet at 70°C and 86% relative humidity for a period of 15 days. (ISO 18916 (2007))
- Peel Strength Test:** at the Canadian Conservation Institute (CCI), Ottawa kgf measurements (ASTM: D6252/D6252M)
- pH Test:** cold extraction method. Ratio of 1:70.
- Colorimeter Test:** Minolta Chroma Meter, CIE standard LAB L*a*b*

Results: FTIR

- Unaged and aged samples: very similar results
- No signs of cross linking or chemical changes
- Small change in absorption near 3000 cm⁻¹ (Group D and F), due to adhesive residue on the paper

Results: pH Test

- Silver gelatin samples: similar results after 1 and 72 hours
- After 1 hour, difference in pH of 0.05
- After 72 hours, difference in pH of 0.02
- Canson paper samples: difference in pH of 0.19
- Strathmore paper samples: difference in pH of 0.05
- The samples were always slightly more alkaline after aging

	pH	
Extraction time	1 hour	72 hours
Group A	5.60	6.07
Group B	5.55	6.09
Group C	5.52	N/A
Group D	5.71	N/A
Group E	5.98	N/A
Group F	6.03	N/A

Conclusions

- The chemical properties of the substrates did not change while in contact with the label during aging. The adhesive did not release any products that might have been harmful to the substrate.
- The aging of the paper in contact with the label did not cause changes in pH, therefore the paper did not become more acidic or more alkaline
- The results show that in all the cases the force required to pull apart the labels and the substrates was always higher when the sample was aged.
- The aging caused the adherence between the labels and the substrates to become stronger.
- The labels do not seems to be damageable to the papers but seems to be the silver gelatin photograph.

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Background image: Astman, Barbara. "Ira and Barbara with Animals in Jungle", National Gallery of Canada

Results: Visual Assessment

- Samples in good condition after aging
- No change in colors, brittleness and adherence with the label
- Silver gelatin samples warped slightly

Results: Removability

- Mechanical removal of the labels
- No use of solvents
- Some samples showed failure of the bond on the substrate surface or the adhesive

	Removability	
Group A	Unaged label on photo (Control)	70% (easy)
Group B	Aged label on photo	65% (failure)
Group C	Unaged label on Canson paper (Control)	90% (really easy)
Group D	Aged label on Canson paper	80% (really easy)
Group E	Unaged label on Strathmore paper (Control)	60% (failure)
Group F	Aged label on Strathmore	50% (more difficult)

Results: Peel Test

- The aged samples were always showing a higher kgf
- Group A and B: difference of 0.16 (from 0.18 to 0.34 kgf)
- Canson paper samples: difference of 0.41 (from 0.25 to 0.66 kgf)
- Strathmore paper samples: difference of 0.22 (from 0.14 to 0.36 kgf)

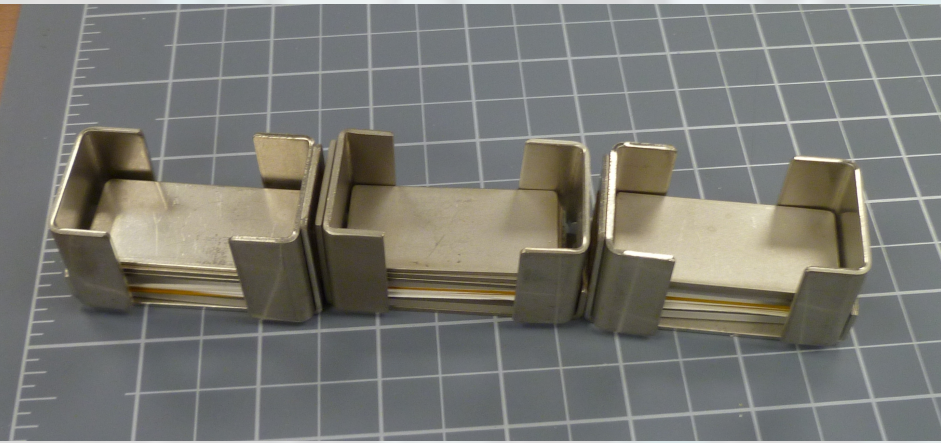
Results: PAT

First PAT

- Gelatin Staining test: pass
- Visual Assessment test: pass
- Silver Image Interaction test: fail
- Overall PAT: fail

Second PAT

- Gelatin Staining test: pass
- Visual Assessment test: pass
- Silver Image Interaction test: fail
- Overall PAT: fail



Results: Colorimeter Test

- Silver gelatin aged samples became lighter (ΔL^* is greater than 0.5)
- Δa^* is smaller than 0.5 in all the samples so there is no perceptible change in degree of red to green.
- Silver gelatin aged samples have yellowed (Δb^* is greater than 0.5)
- $\Delta E_{ab}^* > 1$ for the adhesive side of all the samples and for the silver gelatin emulsion side and so there is an overall perceptible change in color in these groups.

Colorimeter Test	ΔL^*	Δa^*	Δb^*	ΔE_{ab}^*
Unaged and aged Silver gelatin samples (Emulsion side)	3.32	-0.36	0.63	3.40
Unaged and aged Silver gelatin samples (Adhesive side)	-3.13	-0.18	-3.02	4.35
Unaged and aged Canson paper samples (Paper side)	0.48	-0.05	-0.30	0.57
Unaged and aged Canson paper samples (Adhesive side)	-4.40	-0.74	-3.05	5.40
Unaged and aged Strathmore paper samples (Paper side)	-0.29	0.07	-0.27	0.40
Unaged and aged Strathmore paper samples (Adhesive side)	-4.66	-0.86	-2.43	5.32