Face-lifts for Face-Mounting: Fill Materials and Methods for Scratch Repair on Poly(methyl methacrylate) Used in Face-Mounted Photographs

INTRODUCTION:

- A primary conservation issue for the sustained use of face-mounted photographs (FMP) is the long-term stability and inherent susceptibility of the poly(methyl methacrylate) (PMMA) surface to abrasions.
- A scratch on a smooth acrylic surface is composed of a trough, with a depressed center, and ridges, created by the displaced acrylic material. (see Fig. 1)
- When light is reflected by the raised ridges the scratch becomes disturbing visually, therefore by smoothing these ridges, the visibility of the scratch should be reduced.
- This paper examines surface modification methods (scratch-flattening and scratch-scraping) as well as the choice of fill material (an acrylic co-polymer, a UV-curing adhesive, or an epoxy resin) in decreasing the visibility of scratches on the PMMA surface of face-mounted photographs.

EXPERIMENTAL

Step 1: Scratching and Surface Modification

- PMMA surfaces degreased with mineral spirits
- Coupons scratched by 80 granite sandpaper with rub-test machine (Fig. 2)
- Select coupons were subject to flattening treatment (F) with microscopy roller, scraping treatment (S) with razor blade, or were left as is for fill material application.

Step 2: Material Application

- Fill materials were applied manually with syringe/brush and leveled out naturally and with silicon wedge to ease adhesive into scratch troughs
- Curing time varied by material
  1. Acrylic Co-polymer: 20% Paraloid B-72 in 1:4 hexane: toluene
  > highest viscosity and n=1.49
  2. UV-Curing adhesive: Dymax 4-20638
  > longest cure time and n=1.54
  Epoxy Resin: Hxtal NYL-1
  > lowest surface tension and n=1.52

Step 3: Accelerated Aging

- After coupons were able to fully cure (over 2 months undisturbed) they were subjected to thermal and radiant light to simulate extended storage and exhibition conditions.
- Thermal: Samples aged separately
  - B72: 71°C at 50% RH
  - Hxtal: 47°C at 95% RH
  - Dymax: 12°C at 95% RH
- Light: Samples aged simultaneously
  - Exposure to 100,000 lux for a continuous 4.8 hrs
  - 39-43°C – 25-40% RH

RESULTS & DISCUSSION

Paraloid B-72 had the greatest color change and produced the most matte surface, Hxtal NYL-1 had the least color change and produced a surface glossier than unscratched PMMA. While these two fill materials represent the best and worst analytical data sets, an observational study chose both the scratched B-72 and scratch-scraped Hxtal as the most effective in visually reducing surface scratches. Dymax was not as effective as a fill material. With further experimentation on adhesive application methods, the information obtained in this study can be applicable in attempts to fill deep surface scratches on FMP. Further testing to completely obscure surface scratches still needs to be explored.

CONCLUSION

- Application of B-72 created the most matte surface while Hxtal made a surface glossier than untouched PMMA
- While Dymax cured to a glossy surface, too many dust particles were present from the long cure time to be an effective fill
- An observational study of 12 participants voted that the scraped Hxtal NYL-1, and the scratched Paraloid-B72 coupons were the most visibly effective in reducing the prominence of surface scratches.

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