

Experiments in Chemical Restoration of Resin Coated (RC) Photographic Papers

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Introduction

Resin coated (RC) papers, introduced to black & white photography nearly thirty years ago has had its share of stability problems. From emulsion cracking to red spots, these papers deteriorated rapidly. Manufacturers addressed these problems, incorporating base stabilizers, yet to this day RC prints deteriorate more rapidly than their fibre based cousins. This author has reproduced faded RC prints for preservation purposes only two years after their production. Previous works by Feldman, Bard & Lee, and Reilly et. al., have concentrated on the cause of deterioration and prevention.

Background

The mechanism for silver image deterioration in RC prints is well documented. It occurs rapidly, producing red spots throughout the image area. In fibre prints, the process is much slower resulting in a gradual yellowing of the silver image. Several bleach and redevelopment techniques employing either dichromate, copper, or permanganate bleaches have proven successful. For RC papers, these bleaches are too aggressive, causing tremendous loss of image density. The following experiments were carried out to find an effective bleach and developer combination.

Theory

After initial experiments employing various bleaches were unsuccessful, it was apparent that silver was being removed in the initial bleaching stage. Possibly soluble silver oxides and/or silver ions present were being removed. To prevent this a reducing bath was introduced before bleaching, with improved results. The bleach concentrations were also lowered with positive results. The following experiments were based on these results to determine the optimum procedure.

Experimental Method

Restoration procedure was as follows: 1st developer (reducer); 2 minutes, stop bath, 30 sec., wash; 30 sec., bleach, 2 min., wash; variable, developer; 2 min., stop bath; 30 sec., fixer; 30 sec., final wash 1 min., for a total of between 10-14 minutes. 1st developers included D-72 diluted 1:2, D-72 stock solution, and a sodium sulfide solution. Bleaches include potassium dichromate, potassium ferricyanide, and copper chloride.

RC papers from three manufacturers were exposed to a Kodak No. 2 step wedge and tray processed according to manufacturer's instructions. Density readings were recorded and the samples set aside for reference. The remaining samples were exposed to a hydrogen peroxide atmosphere for 24 hours, removed and readings were taken 7 days later. Restoration treatments were then performed within 24 hours. Samples were treated in one of the following processes (minus intermediate steps):

a) dichromate bleach + D-72 developer (1:2)
b) ferricyanide bleach + D-72 developer (1:2)
c) copper chloride bleach + D-72 developer (1:2)
d) D-72 stock + dichromate bleach + D-72 developer (1:2)
e) D-72 stock + ferricyanide bleach + D-72 developer (1:2)
f) D-72 stock + copper chloride bleach + D-72 developer (1:2)
g) Sulfide sol'n + dichromate bleach + D-72 developer (1:2)
h) Sulfide sol'n + ferricyanide bleach + D-72 developer (1:2)
i) Sulfide sol'n + copper chloride bleach + D-72 developer (1:2)

The best treatments were then applied to naturally aged RC prints. Density readings (ND + B filter) were taken along with melting point tests to determine relative emulsion strengths.

Results

As expected from the preliminary experiments, all the peroxide aged samples responded positively to the addition of an initial chemical reducing step. Visually and densitometrically, samples treated in D-72 (stock), and ferricyanide bleach regained up to 96% of original image density, followed by those treated in D-72 (stock) and copper chloride bleach. Samples treated with sodium sulfide failed to retain as much image density and were brownish-grey in appearance. The melting point tests revealed that the samples treated with dichromate bleach had the highest melting point, demonstrating the hardening effect of dichromate, and all samples treated in sodium sulfide had lower melting points, probably due to the high alkalinity (pH 11.0) of that solution.

Conclusions

Visually, the results are dramatic. Both the artificially aged and naturally aged RC prints respond well to the process. Densitometrically, samples regain most of their lost densities and image hue. However, the retrieval of image density must be tempered with the lower emulsion stability.