Abstract

THE STUDY OF PRECURSORS OF PHOTOGRAPHIC COATINGS

AND THE EFFECT OF AGING USING ATR-FTIR

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This research involved the study of various photographic coating precursors and the effect of accelerated aging on these materials. The primary goal of this work was to identify a “chemical signature” for each coating material and to use this information to assess changes in the coating as a result of aging. Ideally, such information could be used by photography conservators to better understand the composition and history of a photographic sample. This work is part of a larger project to characterize photographic materials and identify variations in photographic processes that is being conducted by the Getty Conservation Institute (GCI).

Twenty-three commonly used photographic coating precursors were selected and a high-quality film of each coating was prepared on a glass slide. A chemical signature for each material was determined by measuring the infrared spectrum of each film using Attenuated Total Reflectance Fourier Transform Infrared Spectrometry (ATR-FTIR). Samples of each coating material were then exposed to ultraviolet light for different periods of time ranging from 4 hours to 71 days to artificially age the films. After each exposure, a visual examination of the sample was made and an ATR-FTIR spectrum was obtained. Differences in the physical appearance of the sample and in the infrared spectra were catalogued and interpreted in terms of possible chemical changes occurring in the coating.

Bitumen was found to be very unstable, exhibiting spectral changes with only 4 hours of accelerated aging. The glossy film surface had a matte finish after 3 days of aging. All of the carbohydrate samples were very stable, showing only minor spectral changes at aging times of 9 days or more. The order of stability is approximately: cellulose, potato starch > dextrin > gum arabic > arrowroot starch > agar. Typically, there was a slight darkening/yellowing of the sample film, and several samples cracked and fell of the glass slide at longer aging times. All of the natural resins were relatively unstable with spectral changes occurring after even the shortest aging times. Upon aging, these resin films had deterioration characteristics that included embrittlement, darkening, cracking, and surface efflorescence. All protein films developed a darker, often matte, finish with albumen showing the most significant yellowing. Only albumen showed a significant change in its spectrum at longer (> 9 days) aging times. Collodion was relatively stable, only exhibiting spectral changes after 71 days of aging. The clear film did yellow and become an opaque at earlier aging times. Beewax and paraffin were very

stable and showed very little, if any, physical change upon aging. Slight spectral changes were observed after longer (>18 days) aging times.

In a blind study, a series of photographs was examined by ATR-FTIR and the principal precursor component present in each photograph was correctly identified by comparison of the sample spectra to the library of spectral data accumulated in this project.