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Investigation and Optimization of Electrochemical Treatment for Daguerreotypes

Elyse Canosa and W. (Bill) Wei

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Due to their metallic nature, daguerreotype plates tarnish easily when exposed to atmosphere or other corrosive environments. The removal of such corrosion products has always been a controversial issue due to the irreversibility and potential damage inflicted by the treatment process. When performed using the proper technique and tools, electrochemical cleaning has been shown to remediate daguerreotype corrosion without causing damage to the object. This multi-year investigation explores in detail the effects of electrochemically treating daguerreotypes to better comprehend the physical, chemical, and aesthetic changes which occur during tarnish remediation. Such analysis includes understanding the extent to which tarnish is removed from the object, whether the microstructure and surface roughness are altered, and whether deposits are formed on the surface as the result of cleaning. Before characterizing the effects of treatment, a reliable and consistent electrochemical cleaning method was optimized on modern, custom-made daguerreotype coupons. These coupons were tarnished in controlled settings to produce either silver sulfide or silver oxide, then exposed to electrochemical treatment. Tests were executed to determine the most effective voltages for removing both silver sulfide and silver oxide. Full characterization of the modern coupons was performed prior to corrosion, after corrosion, and after electrochemical remediation to provide full understanding of the treatment effects. Characterization techniques included scanning electron microscopy, x-ray diffraction, Raman spectroscopy, x-ray photoelectron spectroscopy, and confocal microscopy. The optimized process has also been tested on nineteenth century daguerreotypes, and the changes fully characterized and compared to those of modern samples. The results provide a much better understanding of the electrochemical treatment process on a chemical and microscopic level.

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