Applications of Atomic, Molecular and Chemical Physics to Art Conservation

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ABSTRACT

Daguerreotypes were the first form of photographs and were popular between 1840 and 1860, after which they were superseded by more modern techniques. The daguerreotype image is composed of silver/mercury microcrystals of varying size and density on a silver-coated copper substrate. Nineteenth century daguerreotypes, over the intervening 140 years, have suffered degradation and oxidation, which has greatly reduced their historic and artistic value. Laser ablation techniques have been previously explored for use in the characterization, dating, and restoration of historic paintings, parchments, stained glasses, and statues.

We report here the use of a number of modern surface science techniques (especially those using lasers, mass spectrometry, and microscopy) to characterize and analyze both normal and degraded daguerreotypes. Then, attempts to use laser ablation techniques for cleaning and restoring damaged nineteenth century samples will be described. The optimal wavelength, pulse length, pulse energy, and focusing conditions are critical for effective cleaning while preventing damage to the fragile image.

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