Article: Advancements in Daguerreotype Research Using Confocal and Electron Microscopy
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ADVANCEMENTS IN DAGUERREOTYPE RESEARCH USING CONFOCAL AND ELECTRON MICROSCOPY

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Abstract

George Eastman House International Museum of Photography & Film (GEH) has been leading a collaborative investigation of the surface characteristics, material science, and the effects of treatments on daguerreotypes. The partners in this collaboration with GEH are: the NanoImaging Laboratory, Center for Imaging Science, Rochester Institute of Technology (RIT); the Foundation Science and Technology Center (now Corporate Engineering & Analytical Science), Eastman Kodak Company; and NanoFocus, AG. This paper presented initial results of these ongoing investigations that are yielding new information on the material nature of the daguerreotype surface.

One of our research efforts has been in the application of the non-perturbing (non-contact, non-invasive and non-destructive) optical and surface metrological techniques such as confocal scanning disc microscopy to daguerreotypes. White light confocal disc scanning microscopy is shown to be a useful technique for examining the 3D ultra-fine structure of the daguerreotype image. This technique provides exceptional submicron data that can be projected into three-dimensional imaging programs to document the daguerreotype surface structure. Examination at this level allows for measuring changes due to environmentally induced deterioration, and provides comparative data before and after chemical and physical treatment (Ravines et al. 2008). Examples of the application of confocal microscopy showed its potential in assisting the conservator to evaluate both daguerreotype condition and treatments performed on the fragile image structure. To date this instrument is proving to be a powerful research tool suited to the investigation of the daguerreotype image surface (Ravines, P., C. M. Wichern & J-j. Chen. 2008).

The second area of our exploration presented the initial stages of an electron microscopic study of modern and historic 19th century daguerreotypes using state of the art field emission ultra-high resolution scanning electron microscopes (FE UHR SEM) with magnifications ranging from 100,000 to 250,000x, focused ion beam scanning electron microscopes (FIB SEM) to cross section daguerreotypes, and transmission electron microscopes (TEM). These investigations are corroborating the metallurgical nature of the silver mercury amalgam image particles firstly done by Swan et al. (1979) and then by Barger and White (1991). The new images are demonstrating for the first time the nano-texture characteristics of the background surface, and that image particles also show an even finer nano-textured surface than the background surface. The daguerreotypes investigated appear to show nano-textured gold-capped silver nodules ranging in size in the tens of nanometers and ungilded smaller narrower nodule boundary regions. These ungilded nodule boundary regions expose silver metal to atmospheric contaminants thereby allowing tarnish to develop. The nano-texture features of the background surface provide

information that potentially explains the occurrence of tarnish as corrosion in the inter-nodular boundary regions on gilded daguerreotype surfaces.

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