All that glitters is not bronze
Diving into the intricacies of so-called “bronze paint” on gilded wood

Solveig Hoffmann, Stéphanie Auffret, Art Kaplan, Herant Khanjian, Joy Mazurek

The Getty Conservation Institute (GCI) Cleaning of Wooden Gilded Surfaces project aims to address the challenges presented by the cleaning of wooden gilded surfaces and to identify and disseminate appropriate treatment options. Part of this project’s broad scope is the study of “Bronze paints,” which were used on wooden gilded surfaces to retouch or overpaint gilding or as an original “gilding” medium. As representatives of these surfaces, project-specific mock-ups and European picture frames from various time periods were used to study and document different bronze paints, examining both binding media and bronze paint particle morphology. Cross-sections of samples were examined with optical microscopy and elemental composition of the particles was determined by XRF and SEM-EDX, while binding media was identified via FTIR in ATR and transmission modes and GC-MS. Historic and contemporary sources were consulted on materials, production, and application of bronze paints. The project can be found here: https://www.getty.edu/conservation/our_projects/education/cleaning_wooden_gilded/

TERMINOLOGY

Bronze paint, often used to designate any gold-colored paint, is a misleading term, as it contains no bronze. However, other terms like “brass-based paint” do not encompass the whole range of materials used. Hence, the term bronze paint is used as an umbrella term, despite its terminological inaccuracy.

PARTICLE MATERIALS

In the past, most metal-based materials included copper, copper alloys (fig. 4-9), tin (fig. 10), and, after the late 19th century, aluminium (fig. 4, 5). Prior to the increasing use of automated processes of the 19th c., metal particles were made by grinding/milling metal leaf or rolling metal filings. Color was manipulated by alloying, annealing, mixing particles of different materials(fig. 4, 5), and, by the late 19th c., by applying aniline dyes. While the mineral mica (sheet silicate, fig. 1-3) was used on altarpieces or architectural elements in the 17th and 18th c., its use in bronze paints drastically increased in the 20th and 21st c. SEM-EDX analysis on the studied frames identified copper-zinc-alloys, a tin-zinc alloy, and aluminium as particles in the bronze paint.

MORPHOLOGY

The morphology of the individual particles influences appearance: the flatter, bigger, and more horizontally aligned the particles, the higher the gloss and opacity. Particle morphology and distribution can be indicative of material, production processes and application method (see image captions). However, it might also influence response to cleaning systems. Thus, cross-sections of samples from mock-ups and original frames were studied with optical microscopy and SEM in preparation for upcoming cleaning tests.

BINDING MEDIA

Literature reviews show that binding media varied across time and place, and included oils, resins, oleo-resinous mixtures, wax, glues and other proteinaceous binders, starch or cellulose-based binders, gums, “thinned oil varnish,” and, later, nitrocellulose and acrylics. On the frames studied, GC-MS and FTIR revealed oil and oleo-resinous-mixtures as binding media for the bronze paint. Nitrocellulose was found as an additional coating on frame 6. SEM elemental mapping on frame 7 identified lead in the binding medium, most likely as a calcic (fig. 8).

PRELIMINARY CONCLUSION & FURTHER RESEARCH

The cross-sections revealed distinctive visual differences in the material and morphology of particles as well as their distribution. The instrumental analysis identified both particle and binder materials on select historic frames, providing a basis for evaluating the outcome of future cleaning tests. It may also help in characterizing production and application techniques that can be linked to treatments and manuals. Several metal soaps were identified in multiple instances on the samples, which could warrant additional study of additives and corrosion phenomena. Incidentally, some historic treatises have previously described the corrosive properties of certain binding media in relation to metal particles. Ongoing research will use mock-ups to examine the individual influence of flake morphology, binders, and bronze paint application techniques on cleaning methods.

SELECTED REFERENCES


ABBREVIATIONS

ATR: Attenuated total reflectance
BEC: Backscatter electron image
C: Century
EDX: Energy dispersive X-ray spectrometry
FTIR: Fourier transformed infrared spectrometry
GCI: Gas chromatography/mass spectrometry
SEM: Scanning electron microscope
UV: Ultraviolet light
VIS: Visible light
XR: X-ray fluorescence

ACKNOWLEDGEMENTS

We would like to thank Tom Leamer and Michael Schilling for their support of this project, Karen Thesleff and Lynn Lee for their guidance with the XRF analysis, Ellen Hagelkorn for additional SEM analysis, Anna Flanz for printing the poster and Drew Bammert, Joshua Hill and Kaj Skalet for edits.

All images © J. Paul Getty Trust