Raman and XRF: Two analytical techniques for understanding and preservation of works of art

HORIBA instruments are on the cutting edge of these technologies, offering precise and reliable analysis for art conservationists and researchers. The use of HORIBA's Raman and XRF spectroscopes in art not only aids in the preservation and authentication of artworks, but also deepens our understanding of the artistic techniques and narratives of bygone civilizations. **Through the advanced capabilities of HORIBA instruments, we continue to uncover the secrets that lie within the masterpieces of art history.**

In this newsletter, we will delve into three pivotal research papers that highlight the practical use of HORIBA's Raman and XRF spectroscopic instruments in art analysis. These studies exemplify how these techniques have led to breakthroughs in art conservation and historical research.

To know more on this topic, click here.

As an introduction, you can listen to Prof. Phillipe Colomban interview here.

Applications of Raman spectroscopy in Art and Archeology

Martin A. Zieman, Juan Manuel Madariaga, 2020

Raman spectroscopy has become a pivotal tool in the realm of art and archaeology, as evidenced by a surge in research papers and dedicated events like the International Congress on the Application of Raman Spectroscopy in Art and Archaeology. The 10th edition (RAA2019) in Potsdam demonstrated global interest, bringing together researchers from diverse fields to explore Raman applications in art history, archaeology, conservation, and more.

The Journal of Raman Spectroscopy's special issue showcases 20 selected manuscripts, offering insights into **material characterization, conservation challenges, Raman spectroscopy of organic-based materials, and applications in archaeology and forensics**. Micro-Raman spectroscopy emerges as a **powerful, non-invasive tool**, revealing unexpected pigments and proving **versatile in characterizing various cultural heritage materials** such as medieval enamels, decorative tiles... reflecting its expanding role in uncovering hidden aspects of cultural artifacts.

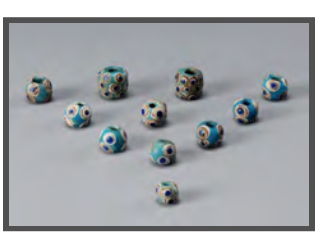
Research Based on Optical Non-Destructive Testing of Pigment Identification

Jigang Wang, Shengcai Hao, Wenhua Zhou, Xiaokun Qi, and Jilong Shi, 2016

This article highlights the essential role of optical methods, particularly utilizing HORIBA instruments, in **non-destructive testing for paintings**. The study, focusing on **Chinese traditional painting pigments**, employs the **Confocal Raman Spectrometer XploRA**, **Energy Dispersive X-ray Fluorescence Microscope Analysis XGT-5000II**, and three-dimensional video microscopy. These instruments reveal insights into **morphology and material construction**, identifying specific pigments like Paris green and Iron oxide red. By determining the first synthesized time of ultramarine blue and Paris green, the completion time of the painting can be identified. The article introduces color analysis methods for building an **expert identification system** by combining optical testing with cultural relic identification.

Multi-technique analysis of an ancient stratified glass eye bead by OCT, μ-XRF, and μ-Raman spectroscopy

Junqing Dong, Qinghui Li, and Yongqing Hu, 2020



In this study, an **ancient eye bead from the Early Warring States Period** underwent non-destructive analysis, including techniques like Optical Coherent Tomography, micro-X-Ray Fluorescence, and micro-Raman Spectroscopy. The bead displayed a sky-blue body, dark blue pupil, and ochre circle pattern, with 3D pseudo-color images from OCT revealing internal structures. **Micro-X-Ray Fluorescence** identified variations in **fluxing agents and colorants**, linking specific elements to different colors.

Micro-Raman Spectroscopy identified **crystal phases** contributing to opacification and coloration. The combined techniques revealed the bead's production through stratified hot-working technology, suggesting its origin as a western ancient natron-type soda-lime glass, possibly introduced to China 1400 years ago. The study underscores the **complementarity of these techniques in non-destructive analysis of cultural heritage artifacts**.

IDFinder, a perfect tool for Raman spectrum identification in Art and Archeology field

IDFinder, our new solution for **Raman spectral identification**, offers advanced tools to recognize the fingerprints of any materials. With the ability to effortlessly create and manage libraries, IDFinder becomes the key, comparing unknown spectra to licensed or customized libraries in a few seconds, enhancing the understanding of artistic compositions and archaeological findings. With a single click, art analysts and archaeologists can identify single spectra, obtaining **instant and accurate matches according to selected libraries**

Furthermore, fast multicomponent deconvolution and identification of spectra gives access to the understanding of complex materials. Then, IDFinder revolutionizes the LabSpec6 experience in art and archaeology, guiding professionals through library selection, creation, and management effortlessly, and **automating the identification of unknown materials**, making the entire process powerful and efficient in the pursuit of unraveling the mysteries of the past and appreciating the nuances of art.

LabSpec 6 apps: Test any app for free

Get a **30-day license** of any App available in the labstore to try out. This opportunity is available for any user of a HORIBA Raman microscope.

Please ask your service contact.

Training Raman

Not yet registered? We still have a few spots left on our upcoming training in our French training center (training are in English)

👉 Raman Multivariate Analysis Training
May, 24

👉 Particle Finder
May, 16

👉 Raman Microscopy Basic Level
May, 13-15

Stay connected!

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