FIXLAB

LLHS, IQFR-CSIC. Laser Cleaning

Description

J. Cult. Herit. 6 (2005) 321-327.

The laser removal of unwanted layers constituted by materials of diverse origins (organic and inorganic), assembled in mixtures (e.g., thick pollution, burial accumulations) or in layers (e.g., multiple protective, metallic, dirt and/or overpaint layers) on weathered, even fragile, original surfaces. The laser action is based on the process of ablation or vaporization and it offers unique possibilities in surface cleaning as it entails precise control, material selectivity and immediate feedback. These attributes are particularly important in Heritage conservation and within the last twenty years, lasers have evolved as exceptionally practical, and at the same time, delicate cleaning tools. This FIXLAB possesses a variety of pulsed laser sources emitting in the ultraviolet, visible and infrared spectral ranges with pulse duration in the nanosecond and femtosecond regimes. Laser cleaning investigations are carried out in the installation on a large variety of heritage materials, including varnished paintings, polychromes on wood or stone, heritage stone with pollution and/or biodegradation crusts, metal substrates with corrosion layers, paper and parchment-based documents and other materials. Studies aimed at determining the most adequate laser parameters and the

most convenient methodologies (choice of laser wavelength, dual irradiation schemes, etc.) for a safe laser cleaning treatment according to material properties and state of conservation.

Fields of application

Cultural Heritage
Archaeological object, architecture, art, decorative arts, film, mosaics, painting, sculpture, textile

Natural Heritage
Fossil, mineral, shell, skeleton

Materials

Inorganic
Ceramic (clay/mud brick/terracotta/earthenware/stoneware/porcelain), glass, stone, metal and metallurgical by-products, pigment

Organic
Binding media, glues, wood, paper, textiles, varnishes

Different laser sources are available for laser cleaning investigations, including Q-switched Nd:YAG lasers (with variable repetition rate), excimer lasers and Titanium:sapphire lasers with pulse duration in the nanosecond and femtosecond domain and a continuous CO_2 laser. Different optical and optomechanical components for control and guidance of the laser beams to the sample are also available. Lateral and axial spatial resolutions are in the micrometre range. The characterization of chemical and physical effects induced upon laser treatment is assessed using different microscopies (conventional and non-linear optical modalities), laser-based spectroscopies and other complementary analytical techniques.

Potential Results

Removal of unwanted layers present on different substrates of Cultural Heritage: optimization procedures (elimination without damage), identification of side effects and design of mitigation strategies.

References

- https://lanamap.iqfr.csic.es/research/researchlines/135-lasers-in-the-conservation-of-cultural-heritage
- Comparison of the use of traditional solvents and nanosecond 213 nm Nd:YAG laser in thinning naturally aged varnish on a contemporary oil easel painting. Martínez-Weinbaum M., Lozano-Garbó M., Maestro-Guijarro L., Carmona-Quiroga P.M., Oujja M., Castillejo M. Heritage 6 (2023) 957-967.
- Influence of wavelength on the laser removal of lichens colonizing heritage stone. Sanz M., Oujja M., Ascaso C., Pérez-Ortega S., Souza-Egipsy V., Fort R., de los Rios A., Wierzchos J., Cañamares M.V., Castillejo M. Appl. Surf. Sci. 399 (2017) 758-768.
- Spectroscopic assessment of the UV laser removal of varnishes from painted surfaces. Ciofini D., Oujja M., Cañamares M.V., Siano S., Castillejo M. Microchem. J. 124 (2016) 792-803.
- Evaluation of laser cleaning for the restoration of tarnished silver artifacts. Palomar T., Oujja M., Llorente I., Ramírez Barat B., Cañamares M.V., Cano E., Castillejo M. Appl. Surf. Sci. 387 (2016) 118-127.
- Practical issues in laser cleaning of stone and painted artefacts: optimization procedures and side effects. Pouli P., Oujja M., Castillejo M. Appl. Phys. A 106 (2) (2012) 447-464.
- Evaluation of femtosecond laser pulse irradiation of ancient parchment. Walczak M., Oujja M., Crespo-Arcá L., García A., Méndez C., Moreno P., Domingo C., Castillejo M. Appl. Surf. Sci. 255 (2008) 3179-3183.

Sample or service requisites

- Samples with a size equal to or greater than 3 mm x 3 mm.

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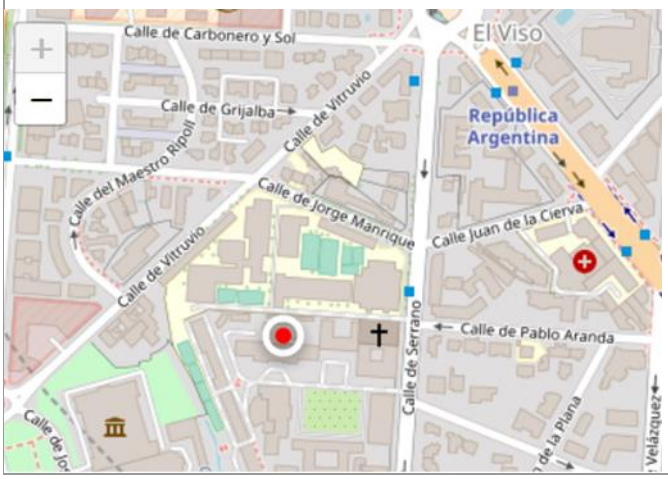
Provider



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