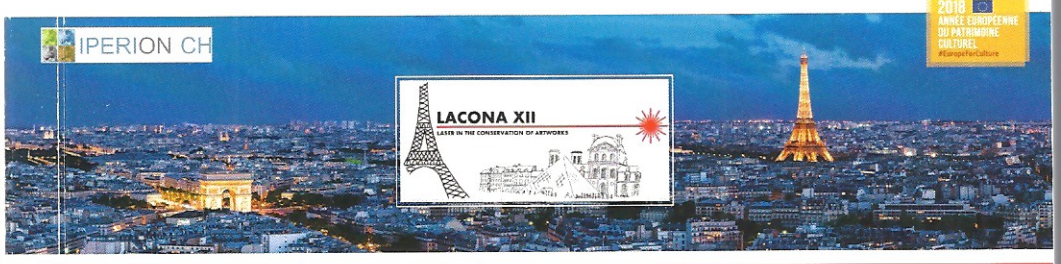

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213 NM LASER ABLATION AS STANDALONE APPROACH FOR DAMAGE-FREE REMOVAL OF AGED VARNISHES : A SPECTROANALYTICAL EVALUATION ON SOLVENT AND OIL TERPENOID COATINGS

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Whenever facing the irreversible and complex operation of thinning down an old varnish from a painting or other coated objects, there are several issues to take into account for the choice of an appropriate treatment methodology. From the mid-nineties, laser-assisted techniques have revealed to be effective in the gradual thinning down of unwanted varnish layers. However, due to the sensitivity to laser light of some pigments, the technique has not yet been established as standalone practice. The most promising approaches, although conceptually different, rely on the use of free running Er:YAG lasers emitting at 2940 um and of pulsed lasers operating in the UV range [1,2]. To date, among the latter, the fifth harmonic (213 nm) of Q-Switched (QS), nanosecond Nd:YAG laser output represents a very attractive solution, as it allows to finely reduce oxidized uppermost varnish layers without any thermal or mechanical effects [3]. Recently, dammar varnish coatings applied on a photosensitive substrate were irradiated using different wavelengths (266, 248 and 213 nm) and pulse durations (ns, ps and fs) and studied by non-linear optical microscopy [4]. Results have confirmed that the 213 nm laser-wavelength is the most indicated for preserving the sensitive paints under the ablated varnish layer, as few microns of binder or remaining varnish are enough to prevent any side effect. In the wake of these positive findings, this work presents the results achieved on wide variety of solvent and oil varnishes, which were irradiated using the fifth (213 nm) and fourth (266 nm) harmonics of a pulsed QS (15 ns) Nd:YAG laser. In detail, samples were prepared by dissolving dammar, mastic, colophony and sandarac in opportune solvents or by cooking them at high temperatures with linseed oil. Then a set of coatings was left under naturally curing conditions, while another set was exposed to artificial lighting. UV-Vis absorption spectroscopy was used as preliminary characterization of the films optical properties. We irradiated sample areas with fluences two times higher than the single-pulse laser ablation thresholds and characterized the physicochemical modifications induced in the ablated varnish layers by a spectroanalytical methodology based on optical and ESEM microscopic examinations, Laser Induced Fluorescence and Raman spectroscopy. Although threshold fluence may vary slightly accordingly to the type of resin in the varnish, preparation procedure and degree of polymerization, the obtained results underline that controlled and damage-free layer-by-layer thinning down of any type of varnish coatings can be achieved using the 213 nm laser-wavelength of nanosecond QS Nd:YAG systems. In comparison to 266 nm, no or subtle spectral variations were assessed through LIF and Raman measurements. Finally, the laser approach presented can have significant implications in cultural heritage conservation as a standalone approach, as it does not require the need of surface pre-wetting and swabbing operations.

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