

Raman/luminescence mapping monitoring of UV-EUV irradiation effect on cellulose for the cleaning of ancient paper surface

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Objective of research:

To characterize the state of conservation of the writing support, highlighting the progress of the degradation process when it has not yet caused evident damage, and to develop products and techniques to prevent or slow down the aging process.

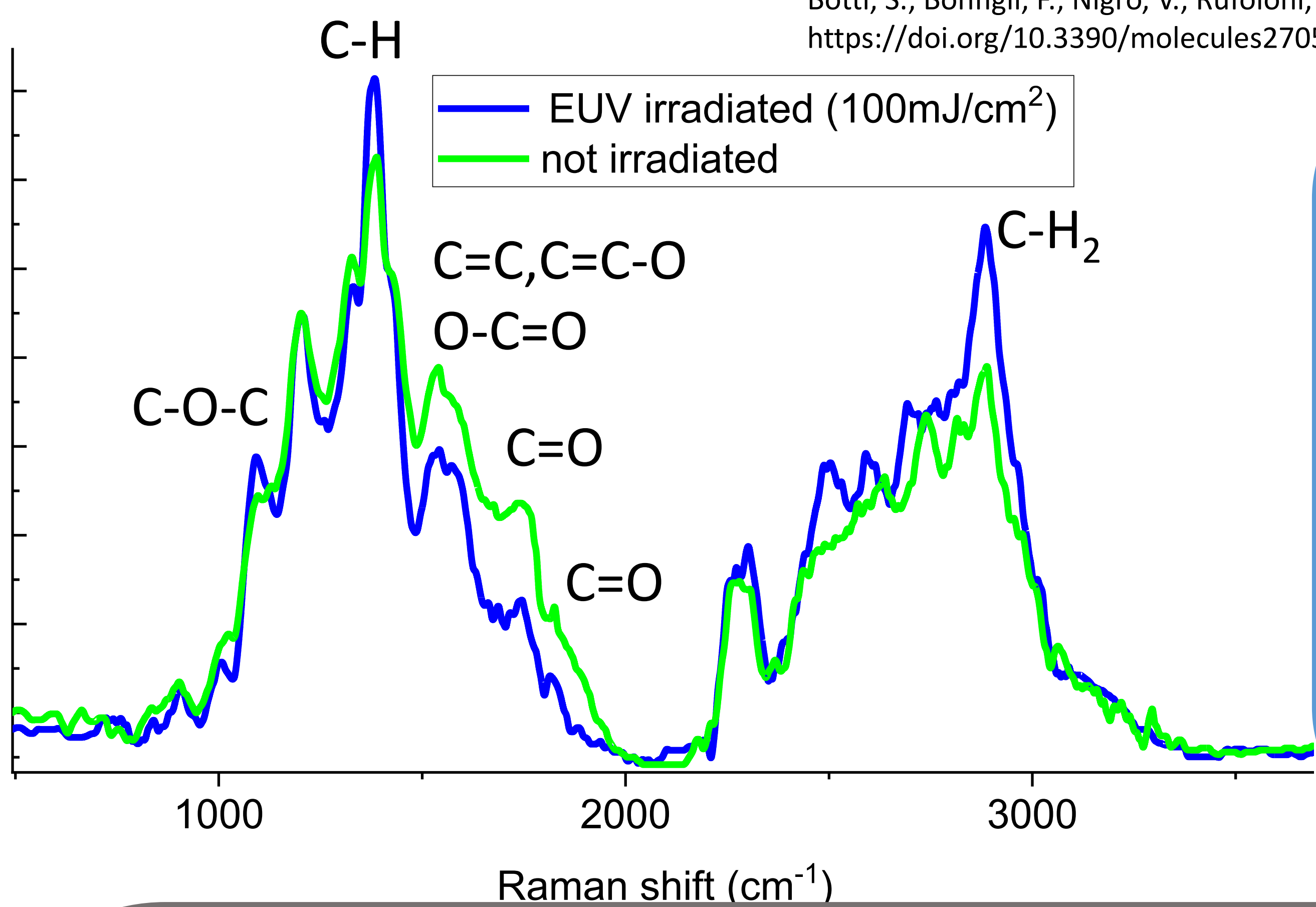
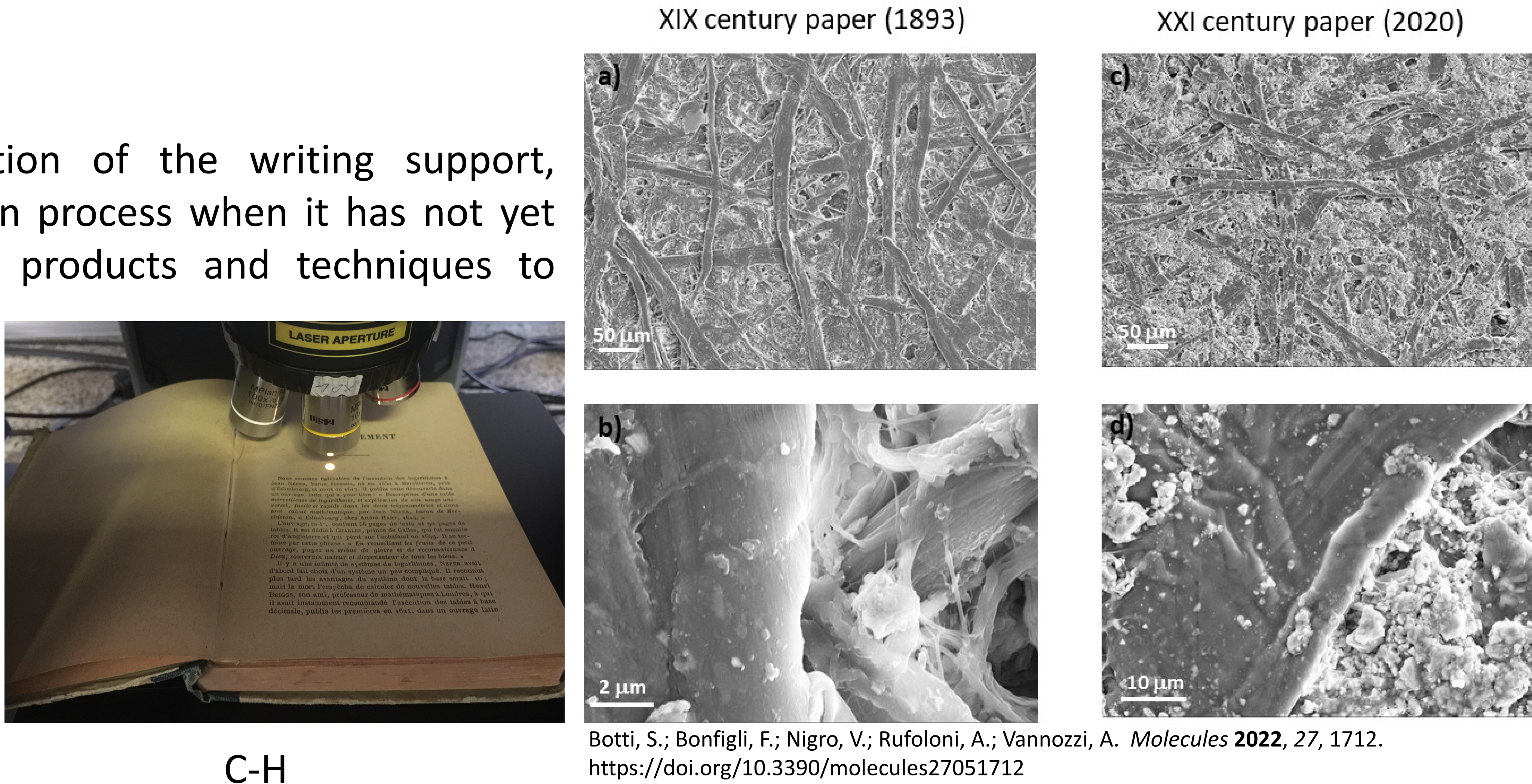
Diagnostic techniques:

The value of gained information about chemical-physical characterization is always balanced against the possibility of damaging or loosing material of historical relevance: particularly for book goods, the restrictions on the possibility of sampling, limit the choice of analytical methods. In this frame, photonic technologies as confocal laser excited spectroscopies resulted to be preferential because they do not need a direct contact with the sample to be studied. We used micro-Raman spectroscopy to obtain aging markers. The variation of markers values accounts for the state of cellulose degradation processes separately.

Paper treatments:

We irradiated ancient/modern papers of XIX and XXI century, with UV radiation in air and in vacuum with EUV radiation, with the aim of defining an appropriate restoration treatment that do not use chemical substances. The EUV (10-18 nm) irradiation mainly produces a decrease of O_I marker value (breaking of C=O bonds) and an increase of C_I marker (formation of inter-cellulose fibers bonds) and R_H (formation of C-O-C linkages). Differently, the UVC irradiation (254 nm) leads to a different behavior for ancient and modern papers. In the case of XXI century papers the increase of O_I and the decrease of R_H indicates an advancement of ageing process, while in the case of old papers the O_I value decreases. This different behavior can be ascribed to the different lignin content.

Although our results deserve further investigation demonstrates that the , our work the use of EUV-UV radiation can be suitable for paper artworks treatments, efficiently monitored with Raman spectroscopy. Both techniques are non invasive and could be exploited in the case of samples of historical value.



Polymerisation degree and hydrolysis advancement:
 $R_H = I_{1100}/I_{1380}$

Oxidation:
 $O_I = A_{1640-1850}/A_{1500-1600}$
 $O_T = A_{1500-2800}/A_{700-3000}$

Crystallinity:
 $C_I = I_{2894}/I_{1380}$

