

Laser cleaning of paper : accuracy, safety and efficacy

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The variety of combinations of different types of foreign matter (dirt) on paper objects can present complex cleaning problems in paper conservation. Current cleaning methods using conventional means (solvents, mechanical) are not always sufficient to solve problems such as local cleaning in the vicinity of sensitive media. Lasers may offer a valuable tool for solving problematic cases. This cooperative research project entitled 'Paper Restoration using Laser Technology' (PARELA, EVK4-CT-2000-30002), funded by the European Commission, has the objective of developing a laser system suitable for the accurate, efficient and safe cleaning of paper objects. Major results of the project will be presented here with emphasis on the practical application of laser cleaning in paper conservation.

A range of cleaning problems that are cumbersome or impossible to treat using conventional methods has been selected by paper conservators participating in the project, including the following types of foreign matter commonly found on paper objects: surface dust; adhesives (natural and synthetic); pressure-sensitive tapes; inks and stamps; 'sticky fingers' (skin surface lipid, possibly combined with dust); stains from foxing, fungi and oil.

Two parallel lines of research have been pursued: (1) critical assessment of the results of laser treatment of a representative group of real paper objects displaying the selected problems; and (2) evaluation of the immediate and long-term chemical and physical alterations of the paper substrate caused by laser treatment, using paper/dirt model systems. The experience gained is used to build dedicated laser cleaning station for paper objects. Central issues are the spatial resolution of the laser guiding system, which is critical for precision work in the presence of sensitive media, and the detection system for monitoring the progress of the treatment in real time. Laser parameters (wavelength, pulse duration, repetition frequency, energy density, laser spot dimensions and overlap, etc.) will be defined to minimise the risk of damage to the paper substrate and other media, while maximising cleaning efficiency. The criteria used to evaluate cleaning efficiency are the extent of dirt removal, selectivity between dirt and paper or dirt and media, aesthetics, and treatment time.

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LANGUAGE: Presentation at the IADA conference will be held in English.