

# An optical surface measurement for laser removal of graffiti

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In this paper, we present the creation of a new class of an optical surface measurement based on laser scattering principle. This technique is aimed to serve as a non-destructive testing tool for laser removal of graffiti. The laser scattering system consists of a weak HeNe laser beam that is split into two arms, the reference arm and the sample arm. The reference arm serves as the unaffected graffiti surface while the sample arm performs as the affected graffiti surface. The diffuse reflection of the scattering light from both arms is projected on a screen. The image of the screen is then captured by a CCD camera. Full Width at Half Maximum (FWHM) of the intensity distribution of the image is analyzed by using a developed image processing program. The measured FWHMs of the two arms can be analyzed and used to identify the laser cleaning threshold. In this study, an experiment on the angular laser removal of graffiti was setup as an example to testify the diagnostic system under practical conditions. A Q-switched Nd:YAG laser operating at 1.06 microns was used to remove graffiti from mortars. The pulse duration of the laser is 10 ns. The laser cleaning procedures were performed by changing the incident angle of the laser beam. The rate of application of pulses was remained at 1 Hz. The laser fluence was varied from  $0.1 \text{ J/cm}^2$  to  $7 \text{ J/cm}^2$ . After the application of individual pulse, the assessment of quality of laser cleaning was performed with the laser scattering measurement. The laser fluence of the cleaning threshold varies between  $2 \text{ J/cm}^2$  and  $3 \text{ J/cm}^2$  according to the sample properties. This laser scattering measurement provides the simplicity of the optical setup and allows the further development of an online surface inspection potentially exceeding the performance of the current optical inspection technology.

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