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An in-situ multi-analytical approach in the restoration of bronze artifacts

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Abstract

A multi-analytical approach was adopted to compare different cleaning methods during the conservation works on two bronze artefacts: the Brera's Napoleon by A.Canova and the Florence Baptistery's North Door by L.Ghiberti. An appropriate number of surface areas were identified and their properties and homogeneity were characterised in situ by means of colorimetry, Eddy Current patina thickness measurements, FTIR spectroscopy and Electrochemical Impedance Spectroscopy (EIS). On the Napoleon statue three sets of laser cleaning parameters were adopted on distinct selected areas. On the North Door a mechanical and two chemical cleaning methods were applied on two separate areas; both chemical methods were based on Agar gel. The results on surface composition, appearance and corrosion rate of the different cleaning methods were compared with the properties of the uncleaned area with the same set of in-situ analytical techniques. Measurements results were statistically analysed to take into account the lack of homogeneity typical of outdoor bronze surfaces.

Based on the results obtained on the two bronze artefacts analysed, the role of the analytical techniques adopted is discussed. The effectiveness of the described in-situ multi-analytical approach towards a better conservation-restoration methodology for outdoor bronzes is enlightened.

Keywords: outdoor bronze monuments; in situ measurements; laser cleaning; portable FTIR; colour measurements; Electrochemical Impedance Spectroscopy

1. Introduction

Analytical techniques applied to Cultural Heritage (CH) problems have now a long history. Since the former studies where pretty large samples were used [1,2], we can nowadays benefit from the growing interest in μ -sampling [3] and Non-destructive Techniques (NdT) [4,5]. In the last decades the development of scientific methods applied to knowledge-restoration-conservation-monitoring of CH was exponentially growing [4-8] and several analytical techniques are nowadays available to investigate topics relevant to cultural heritage. Thanks to the huge evolution in electronic components, sensors and computing devices, in the last years more and more compact and effective portable instrumentation has been developed [7,9]. Thus more and more analytical methods for non destructive and in-situ measurements are available, which are of utmost interest when dealing with masterpieces which should be preserved for future generations. Despite the considerable above mentioned developments in methods and instruments, and because of the huge variety of materials, historical periods,

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