Regular article

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Interface thermal conductance characterization by Infrared Thermography: a tool for the study of insertions in bronze Greek Statuary

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Abstract

In this paper, a new method based on the use of infrared thermography is proposed for the characterization of repairs and inserted parts on ancient bronzes. In particular, the quality of the contact between different kind of insertions and the main body of bronze statues is investigated by analysing the heat conduction process occurring across the interface between them. The thermographic results have been used to establish the nature of these inserted elements and the way they have been coupled to the main body of the statue during and after the manufacturing process.
A model for the heat conduction based on the numerical finite elements method has been applied to compare the obtained results to the theoretical predictions. Measurements have been first carried out on test samples and then in the field on the Boxer at Rest (*Museo Nazionale Romano* in Rome), a masterpiece of the Greek Statuary, which contains a large variety of inserted items and repairs which are typical of the manufacturing process of bronze artefacts in general.

Keywords: infrared thermography; interface thermal conductance; bronze statues; inserted items

1 Introduction

Non-destructive techniques are fundamental for the analysis of cultural heritage artefacts in all the fields of the artistic production. The non-destructive characterization of the structure, the material, as well as of the artistic features of an artefact, constitutes the starting point to determine its conservation state and to study its manufacturing process.
From the artistic point of view, a very interesting application concerns the possibility to study ancient bronzes which, in the past, were largely produced by means of the lost wax method [1,2]. According to this method, several kind of workings are carried out by coupling different elements and materials, during and after the casting, for artistic purposes or with the aim to repair defects and openings associated with the casting. After the casting, in fact, the bronze can present openings made to insert the internal scaffolding, irregularities associated with the entry and exit ports of the