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Use of ED-XRF for the study and conservation of important works of the Italian Cultural Heritage

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Abstract

Various analytical techniques can be used for the study of precious artifacts of historical and artistic interest in order to identify the chemical composition, to evaluate the state of conservation, to assess degradation phenomena, to establish their authenticity. However, among all the analytical techniques on the market today, in situ and non-destructive techniques are preferred in field of Cultural Heritage, when possible. These are two basic points in the field of archaeometric investigations because artifacts of immeasurable value often cannot be removed or moved and the closing of the museum should be limited.

For these reasons, the energy dispersive X-ray fluorescence (ED-XRF) is particularly suited and widely used for qualitative and quantitative elements analysis in this field. Moreover, ED-XRF is a multi-elemental technique, it can be portable and completely battery-equipped, it is fast, universal, not require any kind of sample preparation and it allows to obtain a large number of analytical data and consequently the mapping of the manufact. Therefore, it should be noted that ED-XRF helps art historians, archaeologists, restorers and conservators to learn more about ancient manufacts, their state of conservation, their degradation mechanisms and their provenance.

In this work we show a brief overview of several case studies of ED-XRF analysis for the knowledge and conservation of important works of art of the Italian Cultural Heritage such as Riace Bronzes, David of Michelangelo, outdoor copper statue Sant'Oronzo in Lecce, relief "Madonna and Child" by Jacopo Sansovino, gold jewelry from the National Archaeological Museum of Taranto and the medieval bronze door in Monte Sant'Angelo.

For these investigations, an ED-XRF portable equipment was assembled in our laboratory, using an X-ray tube (MOXTEK Inc., USA) with palladium anode air-cooled and a detector Si-PIN (Amptek Inc., USA). The detector has a resolution of energy of about 180 eV at 5.9 keV and the output of the X-ray tube is adequately collimated.