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APPLICATIONS OF LASER INDUCED BREAKDOWN SPECTROSCOPY (LIBS) FOR CULTURAL HERITAGE: A COMPARISON WITH XRF AND PIXE TECHNIQUES

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ABSTRACT

With the aim to establish advantages and limitations of techniques commonly employed for material characterization of Cultural Heritage objects, we performed comparative measurements by LIBS, X-ray Fluorescence (XRF) and Particle Induced X-ray Emission (PIXE) on four typologies of materials. The samples include: 1) egg tempera pigments on gypsum ground; 2) oil paints on gypsum ground with light or dark *imprimitura*; 3) fragments of decorated glazed ceramic, and 4) ancient Roman coins. The optimal choice of an analytical instrument depends also on the sample type, its dimensions and transportability, and for these reasons our measurements involved two types of instruments per technique. The LIBS probing was done by a table-top instrument (on coins and ceramics) and by a stand-off system at distance of 9.5 m (on pigments). The XRF measurements involved a laboratory micro-XRF system (on coins) and a portable instrument (on pigments and ceramics). The PIXE analyses were obtained by TOP-IMPLART accelerator at ENEA Frascati, using a low energy line that produces the proton beam with adjustable energy between 3-7 MeV (used for the pigments and ceramics), and by INFN-LABEC system with proton energy of 3 MeV and complemented by Elastic Backscattering Spectrometry (EBS), for coin samples. Results relevant to quantitative analysis of major sample constituents, identification of trace components, and stratigraphy are reported and discussed for the examined typologies of samples.

KEYWORDS: LIBS; XRF; PIXE; cultural heritage; stratigraphy