

Design and use of portable X-ray fluorescence devices for the analysis of heritage materials

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X-ray fluorescence (XRF) is a successful technique frequently used for the elemental analysis of cultural heritage materials. It is non-invasive, equipment can be miniaturized and made portable and it allows addressing crucial issues such as fabrication technology, authenticity and provenance of the artefacts.

Depending on components' selection (i.e. the primary source, the detector and the focusing optics, if present), the analytical performance and the consequent suitability to investigate a given class of materials may vary considerably. The present paper discusses the analytical performance - with special regard for the limits of detection and the quantification uncertainty - of two portable XRF spectrometers developed within a collaboration between INFN-LNF-FISMEL and CNR-ISPC. The devices are expressly designed for heritage materials. In particular, one is equipped with focusing optics and is intended to analyse small details on glasses and pigmented surfaces, whereas the other has a 70 kV X-ray tube, which highly improves sensitivity for medium-Z elements, important in copper-based artefacts.

Finally, the paper discusses two case studies, significant to highlight the features of the instruments: one is about Etruscan glass beads and the other about pre-historical copper-based artefacts from Tyrrhenian Central Italy. Thanks to the small size of equipment, both investigations could be easily carried out in situ that is, the Museo Nazionale Etrusco at Villa Giulia in Rome and the Museo della Preistoria della Tuscia e della Rocca Farnese at Valentano.

Summary

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