

## **A NON-DESTRUCTIVE STUDY OF THE COMPOSITION AND MANUFACTURING TECHNOLOGY OF GLASSES AND ENAMELS ON TWENTIETH CENTURY PORTUGUESE GLASS VASES**

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Three glass vases decorated with polychrome enamels were studied by micro energy-dispersive X-ray fluorescence spectroscopy ( $\mu$ -EDXRF), Raman microscopy and reflectance spectroscopy. Colorimetric measurements of the enamels using the CIELAB colour parameters were also performed. All these non-destructive analysis were performed directly on the glass surface without any previous treatment. These glass vases were manufactured in the “Companhia Industrial Portuguesa – CIP” in Marinha Grande and were painted by João Correia following drawings of Jorge Barradas. Their decoration is representative of the Portuguese glass production from the 1930/40s and similar glass objects can be found in various Portuguese museums.

The set of analysis performed proved to be very useful in the chemical characterization of the glasses and enamels of the vases. The production technique was also disclosed and some model enamels were synthesized based on the compositions obtained in the analysis. These model enamels were compared with the enamels in the vases. The results obtained are discussed.

As far as we know there are no studies of this type on Portuguese glass objects from this period. The present research provides important information concerning the manufacturing technique of these particular glass objects giving a contribution not only for the history of the glass production in Portugal but also for the definition of adequate Conservation and Restoration methodologies.