

The use of micro-XRD for the study of glaze color decorations

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Abstract

The compounds responsible for the colours and decorations in glass and glazed ceramics include: colouring agents (transition metal ions), pigments (micro- and nano-precipitates of compounds that either do not dissolve or recrystallize in the glassy matrix) and opacifiers (microcrystalline compounds with high light scattering capability). Their composition, structure and range of stability are highly dependent not only on the composition but also on the procedures followed to obtain them. Chemical composition of the colorants and crystallites may be obtained by means of SEM-EDX and WDX. Synchrotron Radiation micro-X-ray Diffraction has a small beam size adequate (10 to 50 microns footprint size) to obtain the structural information of crystalline compounds and high brilliance, optimal for determining the crystallites even when present in low amounts. In addition, in glass decorations the crystallites often appear forming thin layers (from 10 to 100 micrometers thick) and they show a depth dependent composition and crystal structure. Their nature and distribution across the glass/glazes decorations gives direct information on the technology of production and stability and may be related to the color and appearance.

A selection of glass and glaze coloring agents and decorations are studied by means of SR-micro-XRD and SEM-EDX including: manganese brown, antimony yellow, red copper lusters and cobalt blue. The selection includes Medieval (Islamic, and Hispano Moresque) and renaissance tin glazed ceramics from the 10th to the 17th century AD.

Keywords: Mn pigments, lead antimonate, copper luster, lead calcium arsenates, tin glaze, medieval, renaissance