Reference samples for μ-XRF and TXRF analysis

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Introduction

Advantages:
• Absorption free standard – no matrix correction needed
• Very low substrate background signal, transmission possible
• Wide range of suitable elements for simultaneous detection
• Selection of non-overlapping X-ray fluorescence lines
• Signal strength easily adjustable by layer thickness, comparable peak intensity for all elements
• High degree of lateral uniformity and homogeneity by PVD Mass depositions and energy spectrum

Mass depositions on the sample are in the range from 2 ng/mm² to 20 ng/mm². These amounts were selected to achieve comparable peak heights for all elements. The deposition values listed here with characteristic emission line energies are average values measured by AAS, ICP-OES and μ-XRF.

TXRF reference samples

Special requirements for TXRF reference samples:
• very low deposition (sub-monolayer) of ~ 10⁻¹⁰⁻⁹⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻⁻atoms/cm²
• very good lateral homogeneity: layer rather than droplet „crater”

Challenges:
• scale down the deposition to a homogeneous but not continuous „layer”
• confirm the homogeneity / layer structure
• quantify the amount of deposited material without reference samples

Results

• Successful production of multi-element and sub-monolayer reference samples.
• High degree of homogeneity and reproducibility.
• Low X-ray absorption.
• Large spectral range without line overlapping, emission lines have similar peak intensities.
• Use of membrane substrates in order to withstand high radiation doses, permit transmission and reduce substrate background signal.

Characterization

Various complementary physical and chemical techniques were applied to specify and characterize the reference samples. The element content was quantified with inductively coupled plasma optical emission spectrometry (ICP-OES), atomic absorption spectrometry (AAS) and X-ray techniques such as μ-XRF mappings or grazing incidence XRF.

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