B16 The Use of Isotope Dilution Inductively Coupled Plasma/Mass Spectrometry (ICP/MS) for Precise and Accurate Determination of Elemental Concentration of Trace Elements in Float Glass Standards (FGS1 and FGS2)

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After attending this presentation, attendees will understand basic principles concerning the application of Isotope Dilution-Inductively Coupled Plasma/Mass Spectrometry (ID-ICP/MS) as a method of ultra-precise analyses. Issues such as the required materials and the working procedure will be addressed.

This presentation will impact the forensic science community by raising awareness on the activity of the re-evaluation of the concentration values of Float Glass Standards (FGS) glasses as calibration material for forensic glass analysis by Laser Ablation (LA) ICP/MS.

Over the last two decades, LA-ICP/MS has been proven to be a reliable and powerful technique in forensic glass analysis, especially for the comparative analyses of questioned and control glass samples. Harmonized measurement parameters have been established over time, leading to methods commonly used by the majority of forensic laboratories employing LA-ICP/MS.[1]

In order to improve the accuracy of the quantitative analysis of float glasses by LA-ICP/MS, two matrix-matched standards *(doped with 20 elements of high discrimination power)* were produced in 2002 as part of a Bundeskriminalamt (BKA) research project. These FGS resemble soda-lime glass composition, but vary in their concentration of doped elements by a factor of 5. For more than a decade, FGS1 and FGS2 have been in use by several laboratories serving as matrix-matched calibration standards for the quantitative analysis of float glasses.

Information values for the FGS, validated by different analytical techniques (Atomic Absorption Spectrophotometry (AAS), Inductively Coupled Plasma/**Optical Emission Spectrometer (**ICP/OES), ICP/MS, LA-ICP/MS, Scanning Electron Microscopy with Energy-Dispersive X-ray Spectroscopy (SEM/EDS), and X-Ray Fluorescence (XRF)) were published in 2005.[1] Due to the great capability of isotope dilution ICP/MS in offering results of highest analytical quality and as the most important reference method for elemental analysis, this study will demonstrate the use of Isotope Dilution-Inductively Coupled Plasma/Mass Spectrometry (ID-ICP/MS) for three elements (neodymium, hafnium, and lead) resulting in more accurate and more precise values.[2]

In ID-ICP/MS, a known amount of isotope-enriched (spike) material of the analyte element is added to a sample with known isotopic composition of the analyte element, but with unknown elemental content. This completely mixed isotope diluted sample (blend) contains a new isotope ratio of the analyte element, which directly reflects the analyte concentration in the sample.[2]

The determined isotope dilution values of neodymium, hafnium, and lead for the glasses FGS1 and FGS2 will be compared to already-published data for these glasses. As for these three elements, results of isotope dilution ICP/MS are in good accordance with the neodymium, hafnium, and lead of isotope dilution resulting in a higher precision (lower uncertainty values) of the information values of FGS1 and FGS2. Therefore, this work should serve as a first step for a wider re-evaluation of the concentration values for main, minor, and trace elements in the Float Glass Standards FGS1 and FGS2.

Particular issues regarding the homogeneity of the FGS1 and FGS2 will be presented. Previous analyses have shown that particular areas of the glass (rim) exhibit elevated concentration of Cerium (Ce) and Lanthanum (La). This has been caused by the material applied by the final cutting process of the glass.

References:

1. Latkoczy C, Becker S et al. Development and Evaluation of a Standard Method for the Quantitative Determination of Elements in Float Glass Samples by LA-ICP-MS. *J Forensic Sci*, 2005:50,(6):1327-41.
2. Vogl J, Pritzkow W. Isotope Dilution Mass Spectrometry - A Primary Method of Measurement and Its Role for RM Certification, *J Metrology Soc India* 2010:25(5):135-64.

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