LA-ICP-MS analysis of environmental and archaeological samples

Valentina Lyubomirova and Rumyana Djingova

University of Sofia, Faculty of Chemistry and Pharmacy, 1, Trace Analysis Laboratory, James Bourchier blvd., BG-1164-Sofia, Bulgaria
vlah@chem.uni-sofia.bg

Since the first efforts carried out in the 80s, interest in laser ablation coupled to inductively coupled plasma mass spectrometry (LA-ICP-MS) has been continuously increasing. LA-ICP-MS is currently used for elemental and isotopic analysis in a wide variety of applications, including environmental, geological, biomedical and materials sciences samples. The main advantages of LA-ICP-MS include ease of use, no sample digestion step, relatively high sensitivity and a dynamic range. This allows the simultaneous acquisition and measurement of major, minor and trace elements while offering a high spatial resolution (~ 5 μm) in the low micrometers range. This technique can be considered as non-destructive at macroscopic scale.

One of the most serious drawbacks of the LA-ICP-MS application is the lack of Certified Reference Materials for many sample matrices necessary for instrument calibration. In this case a matrix-matched laboratory standard should be prepared. Furthermore, LA-ICP-MS allows different quantification procedures depending on the sample matrix and the elements of interest which need to be optimized.

The sample behavior under the influence of laser beam differs depending on the type of material which is being exposed to laser ablation. Therefore, the selection of certain parameters such as scanning method, scanning rate, laser energy level, repetition rate and spot diameter is a very important step. The optimization of the DRC (cell gas flow rate and RPq) and RPa-parameter is also a critical point.

In the present work the optimization of the measurement conditions for the simultaneous determination of total element composition of environmental and archaeological samples is presented.