

Utilization of electrodeposition for electrothermal atomic absorption spectrometry determination of elements

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Electrothermal atomic absorption spectrometry (ET-AAS) is one of the most frequently used technique for the determination of elements which occur on the Earth in very low contents. Direct determination of these elements by ET-AAS in samples with a complex matrix, e.g. seawater or biological materials, is affected by different types of interferences. The use of matrix modifiers, Zeeman-effect background correction and isothermal conditions during atomization from a platform or a probe are required for the elimination of interferences. For the determination of analytes concentration at the ng l^{-1} levels the preconcentration stage is required prior to analysis. This step is realized by electrochemical deposition.

Gold was determined by ET-AAS after electrochemical preconcentration on the graphite ridge probe used as a working electrode and sample support. The probe surface was electrochemically modified with Pd, Re and the mixture of both. The electrolysis of Au was performed under galvanostatic control. The sensitivity of Au determination was reproducible for 300 electrodeposition and atomization cycles. When the probe surface was modified with a mixture of Pd and Re the detection limit was 31 ng l^{-1} for 2 min electrodeposition, 3.7 ng l^{-1} for 30 min, 1.5 ng l^{-1} for 1 h and 0.4 ng l^{-1} for 4 h electrodeposition, respectively. The procedure was applied to the determination of Au in river and sea water samples.

Traces of cadmium were determined by ET-AAS after electrochemical preconcentration on the commercial graphite ridge probe modified with Pd. Cd was electrodeposited at a controlled potential (vs. saturated calomel electrode) using the Pd-modified graphite probe as a working electrode. The sensitivity of Cd determination remained unchanged for 300 electrodeposition and atomization cycles.

Noble metals (Pd, Re and the mixture of both) electrodeposited on the probe surface prior to analyte electrodeposition were used not only for thermal stabilization of volatile analytes (Au or Cd) but also protected the graphite surface. The lifetime of the modified probes was prolonged in comparison with unmodified probes, especially in the presence of the high salt content matrix of the real sample.