Electrothermal Vaporization For Sample Introduction In Atomic Absorption And Plasma Emission And Mass Spectrometry

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Pyrolysis curves in electrothermal atomic absorption spectrometry (ETAAS) are traditionally measured to select the maximum pyrolysis temperature that can be applied to remove most of the sample matrix without loosing the analyte(s). Chemical modifiers are generally used in ETAAS to stabilize the analyte and/or to facilitate matrix removal. More recently, this approach has also been adopted in electrothermal vaporization (ETV) sample introduction of solutions, slurries and solid samples in inductively coupled plasma optical emission (ICP-OES) and mass spectrometry (ICP-MS). However, in ETV plasma emission and mass spectrometry the situation is more complicated because the transport of the analytes to the plasma depends on the amount of vaporized substance, so that the degree of removal of the sample matrix may influence the sensitivity. In ETV-ICP-MS, non-linear calibration curves are frequently observed with low-matrix or matrix-free standard solutions. If chemical modifiers co-vaporize with the analyte, their effect is manifested in increased transport efficiency for the analytes, which can be explained by considering that the vapor of the modifier nucleates to a higher extent than the analyte vapor and the latter can condense onto the modifier nuclei. In addition to this, chemical condensation can also be the case with complex matrices when a less volatile compound is formed by a chemical reaction in the vapor phase. We have extensively studied the different behavior of pyrolysis curves for As, Se and Pb in biological materials (slurries with TMAH) in the presence of the Pd/Mg modifier, using the same graphite furnace unit in both ETAAS and ETV-ICP-MS.

Optimization of the temperature program for ETV-ICP-MS work is far more complicated than the traditional optimization of the temperature program in ETAAS. Due to the somewhat higher analyte concentrations used in ETV-ICP-OES, the situation is less critical there. In addition to being a useful technique for solid, slurry and liquid samples, ETV-ICP-MS has proven to be a nice tool for the study of vaporization and atom formation processes in the graphite furnace.

References