New directions in ICP-MS

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This paper will commence with a survey of the general capabilities of ICP mass spectrometry. The present and future impact of new developments in sample introduction (micronebulizers, solvent removal, laser ablation) and instrumentation (collison cells, magnetic sectors) will be surveyed. The general issue of improving absolute detection limits and spatial resolution will be discussed relative to fundamental limits of ion transmission through various parts of the instrument. New research results concerning the origins of troublesome polyatomic ions (e.g., MH^+ and various CrO_x^+ ions) and on-line methods for blank cleanup will be presented.

Sub-ms time-resolved laser ablation-ICP-mass spectrometry

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LA-ICP-MS can provide trace element and isotope measurements for a wide variety of applications in earth and environmental sciences. Incomplete vaporization of laser ablated sample could result in loss of sensitivity, loss of precision and element dependent variations in sensitivity. As a result, measured signals may not be representative of the sample.

Recent results suggest that particles as small as 0.1 μm may not completely vaporized in the ICP. In order to investigate this further we have measured ICP-MS signals produced by laser ablation of a variety of materials with sub-ms temporal resolution, as shown in the figure below.

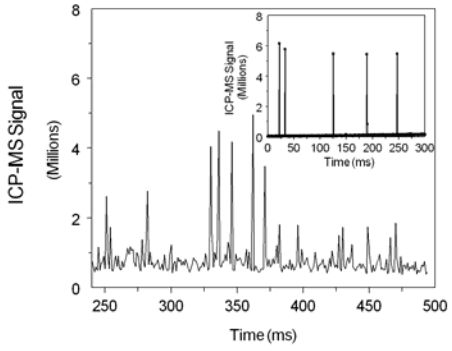

Figure 1. Time-resolved ICP-MS signals with spikes due to vaporizing particles from laser ablated sample or (insert) 1 μm monodisperse silica particles.

Each narrow (<100 μs) spike is due to a single vaporizing (not completely vaporized) particle. Often many such spikes are observed indicating that many particles are not completely vaporized in the ICP. The effect of the laser and plasma parameters and the influence of the sample on the presence of incompletely vaporized particles will be discussed. In order to determine the maximum size particle that is completely vaporized in the ICP we have injected monodisperse silica particles of known, selected size from 0.2 to 1.0 μm. Implications of these results on the accuracy and precision in LA-ICP-MS will be discussed.