

External to the Trap Vaporization and Ionization for Real-Time Quantitative Particle Analysis

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Charge transfer induced matrix effects during the ablation process make quantitative and even qualitative analysis of ambient particles unattainable. The rational solution to this problem is to separate the vaporization and ionization steps. Inside the mass spectrometer, the only method sensitive enough to avoid the matrix effects and yield a detectable signal is the use of an ablation laser pulse subsequently followed by an ionization laser pulse. However, this method suffers from large laser intensity fluctuations of both lasers and changing analyte sensitivities and fragmentation yielding a system that is not very useful for quantitative analysis, especially on a single particle basis. A much better solution would be to use a more universal ionization method such as electron impact or chemical ionization. However, these methods require higher pressures to attain the necessary sensitivity for real-time particle analysis, thereby requiring vaporization and ionization to be performed outside the mass spectrometer. Here we report our progress in attempting to vaporize and ionize particles outside of the ion trap in the ionization chamber of a commercial ion trap mass spectrometer. With this design, we can thermally vaporize or laser ablate the particles and subsequently ionize the nascent gas phase species by electron impact, chemical ionization or glow discharge. The ions produced from the particles are then transferred to the ion trap via an Einsel lens system where they are subsequently interrogated by standard ion trap techniques.

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