

Planar Design Differential Ion Mobility Spectrometer (DMS) as a Prefilter for Portable Atmospheric Pressure Ionization Mass Spectrometers

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Modern trending is for utilization of analytical tools at the sample site (field application), driven by the following factors: a) immediate detection of hazardous sources; b) timely acquisition of threat information allowing for quick and appropriate actions to avoid disasters. API mass spectrometers are powerful tools that can be considered as the “gold standard” for on-site monitoring. But there are two major technical hurdles in constructing a portable API mass spectrometer: a) the vacuum system must have sufficient power to introduce the required sample amount through the MS orifice, and b) the system design must compensate the loss of MS performance due to miniaturization. An effective approach is to combine MS with other fast operating atmospheric pressure separation methods.

A Planar Differential Ion Mobility Spectrometer (DMS) can operate in the regime of generating DMS spectra with a period $\Delta t < 1$ second or as a continuous ion filter selecting specific ion species. A unique property of a planar design DMS is that it enables a transparent mode of operation, which allows immediate comparison of mass spectra with and without ion filtration into the MS: DMS ion pre-separation into a MS is well documented as having the following advantages: Increasing the sensitivity of targeted chemical detection due to substantially decreasing chemical noise in MS spectra. Enabling direct separation of isomeric, isobaric, diastereomeric ions, which is usually challenging for the MS. Enabling in-situ balancing of the selectivity/sensitivity ratio to optimize measurements for specific environmental conditions. In this presentation, we will present a review of planar DMS- APIMS system advantages, show examples of successful mass spectra improvement and present a new miniature DMS design operating with moderate transport gas flow rates.