POSTER ABSTRACT

A Novel Resistive Glass Atmospheric Pressure Ion Mobility Spectrometer

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Ion mobility spectrometry (IMS) is a rapid gas phase separation technique which discriminates between compounds based on their mass-to-charge ratio and molecular cross-section. Atmospheric pressure IMS does not require a vacuum system or any other high power consumption components and is, therefore, well-suited as an ion introduction interface for portable mass spectrometry (MS). Combining IMS and MS effectively adds a 2nd dimension of analysis and a capability for real time, high-throughput separation of complex environmental samples. In this work, we present the first results produced by an atmospheric pressure IMS based on resistive glass drift tube technology. The use of resistive glass tubes ensures a highly-homogeneous electrical field in the drift region and simplifies the design, construction, and connections of the spectrometer. The use of resistive glass tubes also allows for modifications in the length of the drift region in order to customize the instrument for specific applications requiring higher resolving power or having a size constraint. The final goal of the work presented here is to develop a modular and fieldable instrument capable of producing molecular-level information about environmentally-relevant compounds by combining the advantages of increased sensitivity and matrix tolerance of nano-electrospray, the speed of IMS analysis, and the power of MS to identify unknowns.

Environmental analysis often entails identification and quantitation of trace analytes. In order to improve sensitivity of the IMS for trace analysis, we demonstrate the application of an ion-gating multiplexing scheme which encodes the ion beam by applying an arbitrary gating waveform to the Bradbury-Nielson ion gate. The multiplexing scheme increases the duty cycle of the IMS from $<0.5\%$ up to 50%, improving the signal-to-noise ratio of the spectral data collected. Data on the performance of this new IMS drift cell while operating in standalone mode with Faraday plate detection along with preliminary data when operated in IMS-MS mode while coupled to a time-of-flight mass spectrometer will be presented.