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Atmospheric Measurement Techniques Discussions

Interactive comment on "Electrodynamic balance–mass spectrometry of single particles as a new platform for atmospheric chemistry research" *by* Adam W. Birdsall et al.

Anonymous Referee #2

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This paper reports the coupling of an EDB microdroplet balance to a commercial mass spectrometer facilitated by a vaporization platform and corona-discharge ionisation source.

Droplets containing polyethylene glycol (PEG) - with varying molecular-weight ratios are trapped, and left to evaporate, and then the molecular composition of the droplet is analysed using MS. Relative ion abundances, normalised to PEG6, are plotted to model the evaporation of the droplet with molecule-specific detail ie. what proportions of species are left behind comprising the droplet.

The MS result generally fit well to an evaporation model. It is a very interesting new

technique and I think the first time we have seen these evaporation models applied directly to molecular-specific measurements (like MS). Since single droplet mass spectra are measured - the should be great prospects to almost completely control all the droplet properties (composition, size, charge etc) and the environment related to the measurement. There is no ensemble averaging.

There are a few papers emerging recently that are interfacing microdroplet sources with online mass spectrometry techniques - this is, in part, due to the robustness of commercial mass spectrometers that have atmospheric sources like ESI. So interfacing "ambient pressure" droplet sources to these mass spectrometers is rather straightforward as the instruments already come designed with the differentially-pumped to get from droplet to ion detection. Stable sampling is the technical challenge.

Other groups have reported using a paper-spray electrospray ionization (Jacobs et al.) and HV needle desorption (Tracey et al.) , I can also remember seeing some results using DART and single droplet analysis. I hope we will soon see some comparisons between these ionization techniques. Molecular dependent ionization and detection efficiency will always be a key issue.

This paper does well-discuss and highlight the issues around quantitative MS sampling of droplets - particularly when "single droplet" mass spectra are distinguished.

For single microdroplets, droplet-to-droplet variations affect desorption and ionization efficiency and - more insidiously - can affect ions differently. This is the well-known challenge with just about all forms of quantitative mass spectrometry. This paper discusses these concerns towards the end of the results section very well.

This is an excellent paper, a great read and I recommend publication. I dont have any further specific comments or corrections to add.

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