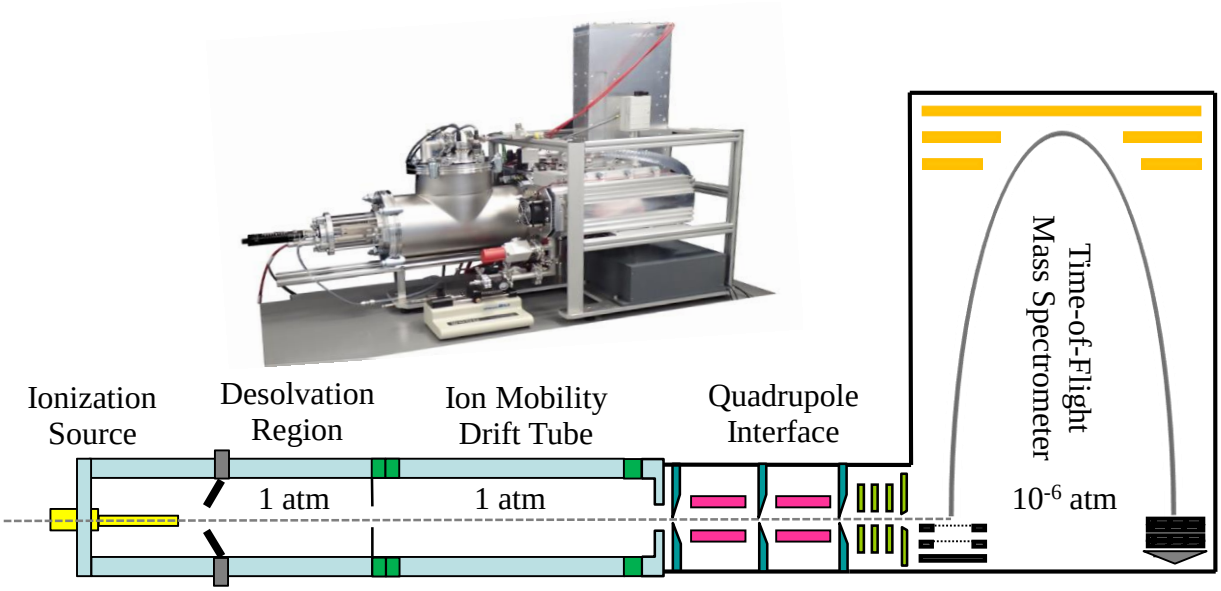
IMS-TOF

Ion Mobility Spectrometer coupled with Time-of-Flight Mass Spectrometer

Characterization of trace gases and aerosols at molecular and isomeric level



APPLICATIONS

- Laboratory, field, or mobile platform based experiments
- Gas-phase photochemistry
  Condensed-phase chemistry
  Cloud processing
- Chemical composition analysis of gases, aerosols, fogs, and cloud droplets
- Interchangeable ionization sources including Electrospray Ionization (ESI) for the particle phase measurement and Atmospheric Pressure Chemical Ionization (APCI) for the gas-phase measurement
- Exploring chemical transformation mechanisms leading to the formation and evolution of atmospheric aerosols.

ADVANTAGES

- High resolution is achieved using a high-pressure, conductive-glass assembly with precision pressure and temperature control
- Best demonstrated separation of species at molecular and isomeric level
- Artifact-free multiplexing for up to 200x sensitivity improvement compared to conventional IMS
- Mobility separation correlated with Collision Induced Dissociation (CID) is ideal for structural elucidation of species
- Custom, dedicated tools for data acquisition and post-processing. Data is stored in the open source HDF5 file format, which is ideal for storing multi-dimensional data.

AERODYNE RESEARCH, Inc.

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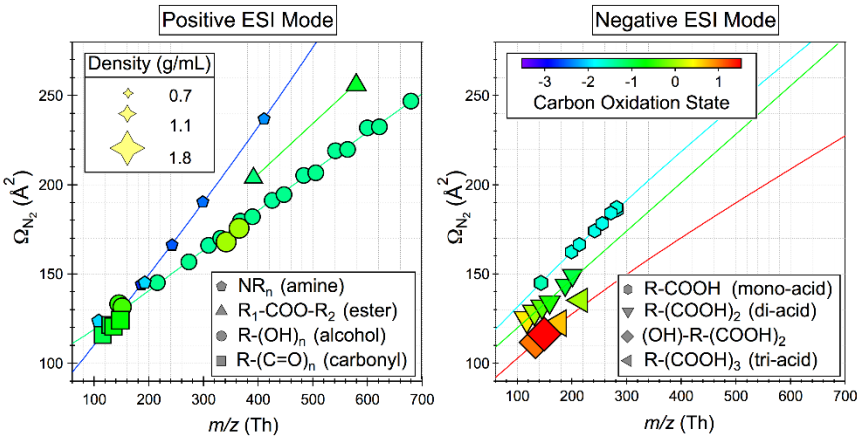
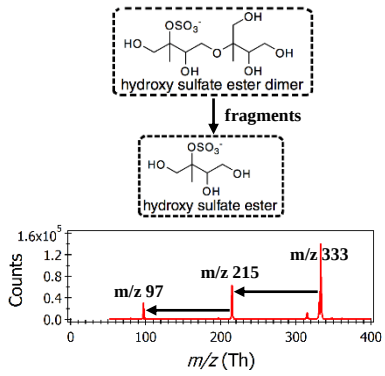
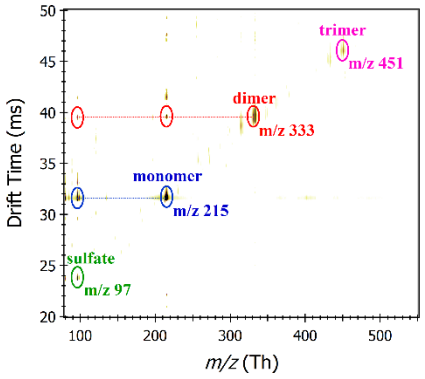
Performance

- Mass-to-charge ratio range (m/Q 0-1500, positive or negative ion)
- Mass accuracy (< 3 ppm)
- IMS resolving power (t/Δt > 100)
- MS resolving power (m/Δm > 4000)
- Sensitivity (> 75 ions/s for 50 nM reserpine in methanol)

Application Examples







<u>2-Dimensional Data Separates Isobaric and Isomeric ions at same m/z.</u>

- Collision cross section (Ω_{N2}) derived from the drift time measurement.
- 2-Dimensional space combines the collision cross section and mass-to-charge ratio (m/z) measurements.
- Species of the same chemical class follow characteristic trend lines (narrow regions in the 2-D space).

<u>Identification of molecules and oligomeric species with correlated drift time and CID analysis.</u>

- Example shows oligomers generated from isoprene photochemistry.
- Structure elucidation of dimers based on its fragmentation pattern upon collision induced dissociation (CID).
- CID analysis is unambiguous since parent dimer ion (m/z 333) and fragment ions (m/z 215 and m/z 97) appear at the same drift time,

References

- Zhang et al.: Evaluation of Hadamard Transform Atmospheric Pressure Ion Mobility Time-of-Flight Mass Spectrometry for Complex Mixture Analysis, Anal. Chem., 2014.
- Krechmer et al.: Ion Mobility Spectrometry – Mass Spectrometry (IMS-MS) for on- and off-line analysis of atmospheric gas and aerosol species, Atmos. Meas. Tech., 2016.
- Zhang et al.: A Novel Framework for Molecular Characterization of Atmospheric Organic Aerosol Based on Collision Cross Section and Mass-to-Charge Ratio, Atmos. Chem. Phys.., 2016.