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Distinguishing Aldehydes and Ketones in Ambient Air using SIFT-MS

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Aldehydes and ketones are the first generation products of atmospheric hydrocarbon oxidation. As such their measurement is a key component in the testing of our current understanding of atmospheric chemistry leading to ozone production.

Trap and analyse methods have been successful for analyzing these species but the rapid chemistry of their production and loss drives the need for measurements on the minute time scale. Mass spectrometric methods have the advantage of wide applicability to the hydrocarbons and the carbonyl compounds with fast time response. However, since this is fundamentally a mass measurement, these methods often cannot distinguish between structural isomers on the basis of the parent ion alone. This is a particular problem for the carbonyl compounds such as methacrolein and methylvinyl ketone produced from the oxidation of isoprene as the aldehyde and ketone have the same mass.

SIFT-MS is a mass spectrometric method that uses three different reagent ions, H_3O^+, NO^+ and O_2^+ for chemical ionization of ambient samples. While the reaction of structural isomers with H_3O^+ produces the same parent ion, the reactions with the other reagent ions are different allowing rapid, real time measurements of structurally isomeric carbonyls.

We will discuss the methodology of this technique and some preliminary ambient measurements taken in a small city.