



Development of a Chemical Ionisation Reaction Hadamard Transform Time-of-Flight Mass Spectrometer

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Chemical Ionisation Reaction Time-of-Flight Mass Spectrometry (CIR-TOF-MS) has proven to be a versatile tool for the analysis of Volatile Organic Compounds (VOCs). It has applications in monitoring of VOCs in ambient air both indoors and out, at both rural and urban sites and has recently been utilized during various atmospheric simulation chamber studies investigating gas phase kinetics and secondary organic aerosol formation.

The main advantages of CIR-TOF-MS over traditional quadrupole-based Proton Transfer Reaction Mass Spectrometers is that it is able to analyze over a broad range of m/z channels in any one instant, as opposed to focusing on specific mass channels. This provides a rapid acquisition of data while still achieving ppbV level detection limits. Unfortunately, the technique suffers from a low duty cycle owing to the conflict between the continuous ion source and the pulsed nature of a TOF analyzer. As such the sensitivity of the technique is directly correlated to the duty cycle, and therefore increasing the duty cycle will open the technique up for a greater number of atmospheric monitoring applications where sensitivity on the sub-ppbV level is desirable on a rapid time scale. This can be achieved through the use a Hadamard Transform encoded TOF ion signal, as developed by the Zare group.

The work presented here details the development of the first Chemical Ionisation Reaction Hadamard Transform TOF-MS. The principles of the technique, instrument operation and applications are illustrated and preliminary results are described.