Investigations of the GCxGC-HRMS coupling

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Since early stages of development where thermal desorption modulation (TDM) was performed on delicate capillary column covered with electrically conductive paint, lots of improvement have been attained and made GCxGC as we know it today. Most of the efforts have for long been focused on the modulation itself to ensure robustness and reproducibility of the process. The availability of both cryogenic dual stage and valve-based modulators in combination with the array of existing GC phases offers the opportunity to subject many types of different semi-volatile mixtures to enhanced separation.

Nevertheless, the detector itself is another important GC×GC system component that must offer a sampling rate compatible with typical peak widths of 50 to 600 ms for zone compressed peaks. Next to flame ionization detectors (FIDs), micro electron-capture detectors (μECDs), nitrogen-phosphorus detectors (NPDs), nitrogen or sulfur-specific chemiluminescence detectors (N(or S)CD), and atomic emission detectors (AED), which have often been reported as GCxGC detectors, mass spectrometric (MS) detectors are offering an extra dimension to the system. Since early 2000, low-resolution time-of-flight MS (LRTOFMS) has been used because of its capability to acquire data at rates up to 500 complete spectra per seconds and additionally offer efficient mass deconvolution. Although LR quadrupole MS (LRqMS) were not successful at that time because of the limited (<5 scans/sec) acquisition rate, new generations of qMS analysers allow faster scan rates and are now successfully used in GCxGC.

Next to those LRMS instruments, the goal is now to access better mass resolution for GCxGC. The coupling with both high resolution sector MS instruments (HRsMS) and HRTOFMS instruments is thus investigated. The use of HRsMS is challenging as this scanning analyser has to be pushed to its better capabilities to allow fast scan rates (20 Hz) while maintaining sufficient MS resolution ($R \geq 10.000$). Selected ion monitoring (SIM) mode is used in order to attain the better sensitivity (<ag). The use of HRTOFMS is promising as it can offer an attractive compromise between HR ($R \geq 5.000$), sensitivity (<pg), mass range (m/z 4.000), and full-scan capability for potential elemental composition determination.