

C60-TOF-SIMS: A TOOL FOR HIGH-RESOLUTION IN SITU MAPPING OF ORGANIC COMPOUNDS. D. Rost, T. Henkel, A. King and I. Lyon, The University of Manchester, School of Earth, Atmospheric and Environmental Sciences, Williamson Bldg. Oxford Rd., Manchester, M13 9PL, UK, detlef.rost@manchester.ac.uk.

Introduction and experimental: Secondary ion mass spectrometry (SIMS) and time-of-flight- or ToF-SIMS are established techniques to measure trace element concentrations and/or isotopic composition on a micrometer or even sub-micrometer scale. ToF-SIMS offers the additional advantage of almost negligible sample consumption. The typically used primary ion species (O_2^- , Ar^+ , Ga^+), however, tend to fragment and hence destroy larger molecules so that organic compounds are difficult to detect. A new generation of ion guns utilizes heavier primary ions (Au_n^+ , Bi_n^+ , C_{60}^{n+}), resulting in a more gentle desorption of larger/organic molecules, especially when using C_{60}^{n+} [1,2].

Recently one of our IDLE ToF-SIMS instruments [3,4] was equipped with a 40 kV C_{60} primary ion gun from Ionoptika Ltd [5] and a 20 kV post-acceleration detector from Kore Technology Ltd was also installed to enable efficient detection of organic compounds. Measurements can be routinely performed with a lateral resolution of 1–2 μm . Sub-micrometer resolution is possible at the expense of intensity.

Ultimately, we want to introduce this technique to cosmochemistry as a reliable tool to measure organic compounds in extraterrestrial materials with micrometer resolution. First results have been obtained from Stardust aerogel [6,7] but require further substantiation through analyses of organic standards.

Results: Several polycyclic aromatic hydrocarbons (PAHs, on Al substrate) have been analyzed to study their fragmentation patterns (Figure 1). In the mass range $m/z > 60$, the main mass of the substance represents the strongest peak in the spectrum (Phenanthrene: 178.08 u, Tetracene: 228.09 u, Pentacene: 278.11 u). Moreover, most PAH fragment peaks have intensities more than ten times lower than the characteristic main peak.

Outlook: Many more substance classes (e.g. lipids, sugars, amino acids) have to be studied before unambiguous identification of organic compounds is feasible. However, the results so far are very promising.

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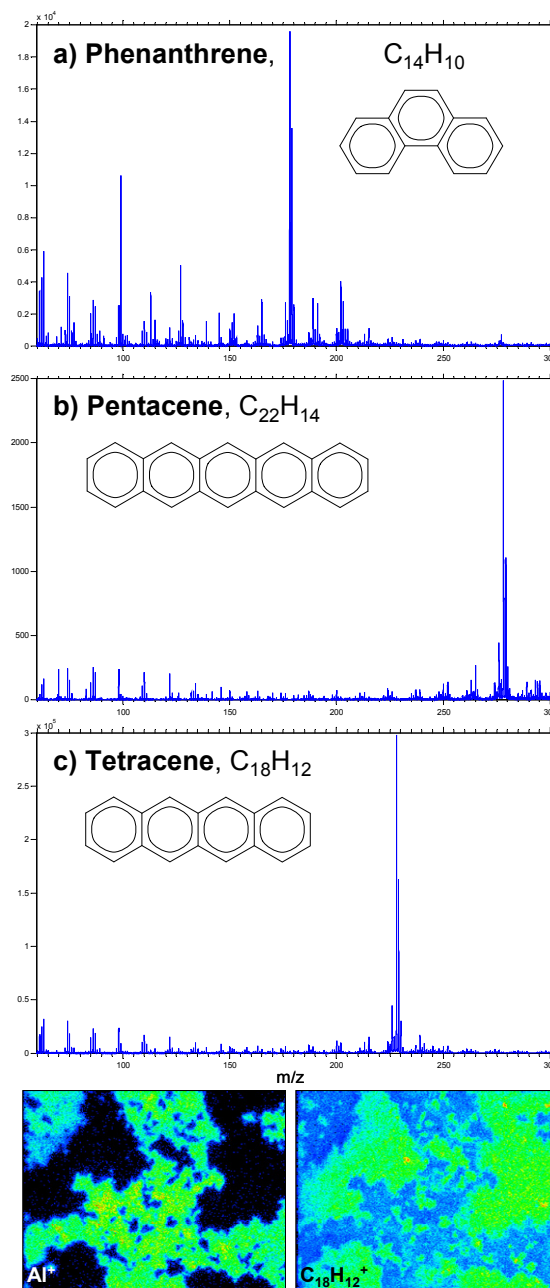


Figure 1: C_{60} -ToF-SIMS spectra and secondary ion images of several PAHs on Al. Field of view is $480 \times 365 \mu m^2$ for all measurements.

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