Mass spectrometry near comet 67P (Rosetta/COSIMA)

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1 The Project

Launch: 2 Mar 2004, Ariane 5, Kourou, French Guiana

On the way: 10 years, 5 months, 4 days (11 months hibernation)

4A RESULTS: Mean spectra

Cometary particles

4B RESULTS: Distributions of % ions

Cometary particles

Meteorite grains

4C RESULTS: Principal Component Analysis (PCA)

5 SUMMARY

Including data evaluations not mentioned here [2, 4, 6, 10].

› Cometary particles appear diverse and different from CC meteorites.

› Composition of cometary particles is close to that of chondritic meteorites but enriched in Si and C and depleted in Mg [12].

› Cometary particles show higher carbon contents than the carbon-rich meteorites (CC Allende, Lincoln, Murchison).

› Cometary particles consist of ~55% silicates and ~40% carbonaceous material (mass) [1].

› Carbonaceous material: mostly macromolecular substances [3].

› Ions C2+...CH3+, CH+, CH2+, CH+, H3C+, H3C+, H2C, etc. indicate unsaturated organic compounds in cometary particles [14].

Details, more references, PDFs: http://www.lcm.tuwien.ac.at/comeccs/

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Posters will be set up during the whole MassSpec Forum Vienna.
Introduction

The time-of-flight secondary ion mass spectrometer (TOF-SIMS) COSIMA on board of the Rosetta spacecraft has collected and analyzed dust particles near the comet 67P/Churyumov–Gerasimenko. Meteorite grains have been analyzed as reference samples using a laboratory twin instrument of COSIMA. Current results are summarized.

Methods

The COSIMA instrument collected on metal targets (mostly Au, 1cm x 1cm) about 1400 particles (size up to 1 mm, ~35,000 fragments) during the >2 years next to the comet (typical distance to the comet 10 - 200 km, typical exposure time 1 - 7 days). On about 250 particles TOF-SIMS spectra have been measured, and about 33,000 full spectra have been sent to Earth, together with images (1024 x 1024 pixel) of the targets. Additionally, about 6,000 spectra have been measured on 10 meteorite samples from the collection in the Natural History Museum Vienna. Spectral data interpretation was mainly based on ratios of secondary ion counts, correlation of signals, and multivariate (chemometric) methods.

Results

- Cometary particles consist of ~55% silicates and ~45% carbonaceous material (mass) [1].
- Carbonaceous material consists mostly of macromolecular substances [2].
- Presence of ions C$_3$H$_{0-4}$+ in the spectra indicate unsaturated organic compounds [3].
- Elemental composition of cometary particles is close to that of chondritic meteorites but enriched in Si and C [4].

References

www.lcm.tuwien.ac.at/comecs/ (Project CoMeCS)

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