Abstract

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Hornung K., Mellado E.M., Paquette J., Fray N., Fischer H., Stenzel O., Baklouti D., Merouane S., Langevin Y., Bardyn A., Engrand C., Cottin H., Thirkell L., Briois C., Modica P., Rynö J., Silen J., Schulz R., Siljeström S., Lehto H., Varmuza K., Koch A., Kissel J., Hilchenbach M.:

Electrical properties of cometary dust particles derived from line shapes of TOF-SIMS spectra measured by the ROSETTA/COSIMA instrument.

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Between Aug. 2014 and Sept. 2016, while ESA's cornerstone mission Rosetta was operating in the vicinity of the nucleus and in the coma of comet 67P/Churyumov-Gerasimenko, the COSIMA instrument collected a large number of dust particles with diameters up to a millimeter. Positive or negative ions were detected by a time-of-flight secondary ion mass spectrometer (TOF-SIMS) and the composition of selected particles was deduced.

Many of the negative ion mass spectra show, besides mass peaks at the correct position, an additional, extended contribution at the lower mass side caused by partial charging of the dust. This effect, usually avoided in SIMS applications, can in our case be used to obtain information on the electrical properties of the collected cometary dust particles, such as the specific resistivity ($\rho_r > 1.2 \cdot 10^{10}$ Ωm) and the real part of the relative electrical permittivity ($\varepsilon_r < 1.2$). From these values a lower limit for the porosity is derived ($P > 0.8$).