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Laboratory calibration of Rosetta/COSIMA: preparation for comet 67P/Churyumov-Gerasimenkov

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The Rosetta spacecraft – launched in 2004 – carries the **CO**metary **S**econdary **I**on **M**ass **A**nalyser (COSIMA) on board. COSIMA is a high-resolution ($m/\Delta m \approx 2000$ at $m = 100\,\mathrm{amu}$; from FWHM) time-of-flight mass spectrometer dedicated to the in-situ analysis of ($10\,\mu\mathrm{m}$ and bigger) dust grains in the coma of comet 67P/Churyumov-Gerasimenkov beginning in 2014. Grains collected on metal black substrates are identified with an optical camera. An indium ion beam is used to sputter material from the grain surface, and the released secondary ions are accelerated in an electric field to form secondary ion time-of-flight mass spectra. The goal of the COSIMA investigation is the in-situ characterisation of the elemental, molecular, mineralogical, and isotopic composition of dust in the coma of comet 67P/C-G. To this end, we perform an extensive laboratory calibration program with a COSIMA reference instrument (RM), a twin of the flight instrument, located at Max-Planck-Institut für Sonnensystemforschung (MPS) at Katlenburg-Lindau. We prepared cometary dust analogue samples from well-defined natural and synthetic minerals (pyroxene, olivine, hydrous silicates, sulfides, etc.), which – except for hydrous minerals – have been unambiguously identified in cometary matter. Spectra of these samples were obtained with the

COSIMA RM and with laboratory time-of-flight secondary ion mass spectrometer (TOF-SIMS) instruments located at the University of Münster/Germany and the Laboratoire de Physique & Chimie de L'Environment at Orléans/France. We present results from measurements on mineral samples (powder with grain sizes $> 10\,\mu\mathrm{m}$) prepared on different substrate materials (gold, silver, gold black). Usually, spectra of sample and substrate are very similar due to the high sensitivity of TOF-SIMS for surface contaminants, implying that very careful sample preparation is necessary. Signals from repeated measurements at the same sample (or substrate) location are fairly stable due to good internal stabililty of the COSIMA instrument. On the other hand, measurements obtained at different sample locations on the same natural mineral vary from one location to the next which may be due to sample inhomogeneities.