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COLLECTING COMET DUST PARTICLES AT LOW IMPACT VELOCITY: HERITAGE FROM COSIMA

Abstract

Comet dust plays an important role with regard to identifying which refractory materials (minerals as well as organics) were already present in the early Solar System. In 2006, an aerogel collector with coma dust from comet 81P/Wild 2 was returned to Earth for laboratory analysis. It featured various types of grains, including specimens that had disintegrated along the deceleration tracks when entering the aerogel. From 2014 to 2016 the COSIMA instrument aboard the Rosetta mission at comet 67P/Churyumov-Gerasimenko performed in-situ secondary ion mass spectrometry of the coma dust grains collected on specially designed metal covered target plates. The regularly obtained in-situ images of these plates showed that the dust particles were collected either completely intact or fragmented into their sub-structures. The dust from 67P entered the instrument with speeds ¡10 m/s, however the collection method would work up to about 200 m/s. Therefore, if a comet rendezvous mission or a low velocity fly-by is envisaged in the future, advantage should be taken of the heritage of the COSIMA instrument. The sample acquisition and imaging system of COSIMA can be used to collect coma dust particles with speeds up to 50 m/s and image them subsequently. The 1x1 cm2 target gold plates are covered by a layer (10-30 m) of gold black, a very porous aggregate of nanometer sized blocks (mean density 2 g/cm3) held together by adhesive forces, to decelerate and cling the incoming particles onto the plate without destroying them. As the adhesive force between the gold black and the collected particles is very strong, it would be possible to return the target plates to the Earth without losing the collected particles. As an addition or alternative to a sample return the collected dust particles could be also be analysed in-situ by a small electron microscope (SEM).