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Laboratory measurement supporting VIRTIS-M data on 67P/CG

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Abstract

Among the primary goals of the VIRTIS instrument [1] onboard ESA Rosetta mission is to provide the surface composition of the comet 67P/Churyumov-Gerasimenko. The objective of this work is to discuss the needed laboratory measurements on particulate samples supporting the interpretation of the VIRTIS-M spectra.

1. Introduction

Laboratory activity has always been of great importance for the understanding and the interpretation of remote-sensing data. This is also the case of the VIRTIS spectrometer [1] onboard Rosetta mission, currently orbiting the 67P/CG comet.
The VIRTIS instrument is composed of two channels: VIRTIS-H, a high resolution cross-dispersed spectrometer working in the spectral range between 2 and 5 μm and VIRTIS-M, an imaging grating spectrometer based on a Shafer-Offner telecentric optical design. The task of VIRTIS-M is the mapping of the comet, in particular its nucleus, in the spectral range from 0.25 to 5.1 μm at moderate spectral resolution (1.8 nm/band for wavelengths below 1 μm and 9.7 nm/band above 1 μm) [1].

2. Laboratory facilities

The Astrophysical Laboratory of the University of Salento can rely on two Perkin-Elmer spectrometers covering the spectral range between 0.2 and 25 μm. Both instruments are equipped with Labsphere integrating spheres for measurements of directional-hemispherical reflectance of solid and particulate samples. In addition, a Malvern laser granulometer allows to characterize the grain size distribution of the analyzed sample for a better interpretation of the reflectance spectra.

3. Measurements

Currently, waiting for the perihelion, the work is focused on the composition of the uppermost layer of the cometary surface, in particular the very low albedo and the broad feature centered at 3.2 μm [2]. We have examined some materials, in the range of interest, mainly carbonaceous, with different origin and characteristics. Their spectra are shown in Fig. 1.

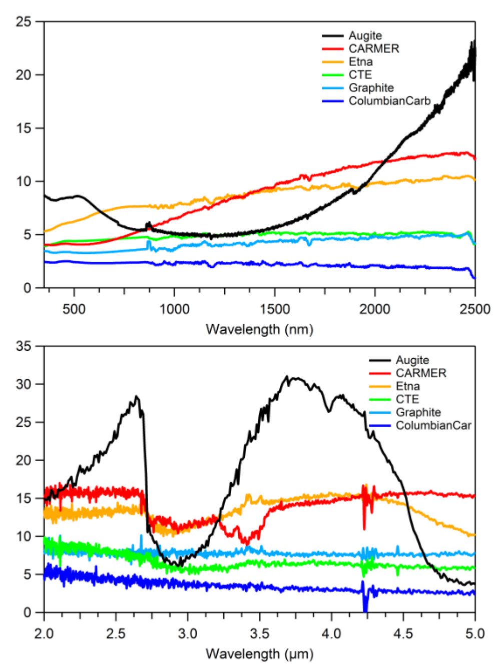

Figure 1: Spectra of several samples analyzed in two different spectral range (350-2500 nm, top panel, and 2.0-5.0 μm, bottom panel): Augite from Harcourt, Ontario; CARMER, carbon from Mericourt mine (Calais, France); Etna, basalt from Etna volcano; CTE, coal tar extracted (Sermide, Italy); pure graphite; pure carbon (ColumbianCar).

The choice of the materials was driven by the need to reproduce the slope in VIS-NIR, the very low albedo and the shallow band at 3.2 µm. We have analyzed three different carbonaceous materials characterized by a low albedo in the whole spectral range (CTE, Graphite and ColumbianCar), a mature carbon (CARMER) showing the slope in VIS-NIR and the feature at 3.2 µm, and two silicate materials: a volcanic basalt (Etna) and a pyroxene (Augite). We are currently analyzing the spectral behaviour of some other materials and, then, we shall characterize their composition and morphology. The objective of the work is trying to fit the observed cometary spectrum focusing on the possibility of a binary mixture of pyroxenes and carbonaceous materials, taking also into account, if possible, the influence of the grain size.

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