CONTROL ID: 2566392

TITLE: Reflectance spectroscopy of natural organic solids, iron sulfides and their mixtures as refractory analogues for Rosetta/VIRTIS' surface composition analysis of 67P/CG

ABSTRACT BODY:

Abstract (2,250 Maximum Characters): Analysis of 0.25-5 µm reflectance spectra provided by the Visible and InfraRed Thermal Imaging Spectrometer (VIRTIS) onboard Rosetta orbiter revealed that the surface of 67P/CG is dark from the near-UV to the IR and is enriched in refractory phases such as organic and opaque components. The broadness and complexity of the ubiquitous absorption feature around 3.2 µm suggest a variety of cometary organic constituents. For example, complex hydrocarbons (aliphatic and polycyclic aromatic) can contribute to the feature between 3.3 and 3.5 µm and to the low reflectance of the surface in the visible. Here we present the 0.25-5 µm reflectance spectra of well-characterized terrestrial hydrocarbon materials (solid oil bitumens, coals) and discuss their relevance as spectral analogues for a hydrocarbon part of 67P/CG's complex organics. However, the expected low degree of thermal processing of cometary hydrocarbons (high (H+O+N+S)/C ratios and low carbon aromaticities) suggests high IR reflectance, intense 3.3-3.5 µm absorption bands and steep red IR slopes that are not observed in the VIRTIS spectra. Fine-grained opaque refractory phases (e.g., iron sulfides, Fe-Ni alloys) intimately mixed with other surface components are likely responsible for the low IR reflectance and low intensities of absorption bands in the VIRTIS spectra of the 67P/CG surface. In particular, iron sulfides are common constituents of cometary dust, "cometary" chondritic IDPs, and efficient darkening agents in primitive carbonaceous chondrites. Their effect on reflectance spectra of an intimate mixture is strongly affected by grain size. We report and discuss the 0.25-5 µm reflectance spectra of iron sulfides (meteoritic troilite and several terrestrial pyrrhotites) ground and sieved to various particle sizes. In addition, we present reflectance spectra of several intimate mixtures of powdered iron sulfides and solid oil bitumens. Based on the reported laboratory data, we discuss the ability of iron sulfides to suppress absorption bands of other cometary refractory components and to affect the spectral slopes and reflectance values of the 67P/CG surface at different wavelengths from the near-UV to the IR.

CURRENT * CATEGORY: Laboratory Research

CURRENT : None

AUTHORS (FIRST NAME, LAST NAME): Lyuba V. Moroz[1, 2], Kathrin Markus[2], Gabriele Arnold[2], Daniela Henckel[2], David Kappel[2], Ulrich Schade[3], Batiste Rousseau[4], Eric Quirico[6], Bernard Schmitt[6], Fabrizio

Capaccioni[5], Dominique Bockelee-Morvan[4], Gianrico Filacchione[5], Stéphane Érard[4], Cedric Leyrat[4]

INSTITUTIONS (ALL): 1. Institute of Earth and Environmental Science, University of Potsdam, Potsdam, Germany.
2. German Aerospace Center (DLR), Berlin, Germany.
3. Helmholtz-Zentrum Berlin (HZB) for Materials and Energy, Berlin, Germany.
4. LESIA - Observatoire de Paris/CNRS/UPMC/Université Paris-Diderot, Meudon, France.
5. INAF-IAPS, Istituto di Astrofisica e Planetologia Spaziali, Rome, Italy.
6. Universite Grenoble Alpes, CNRS, Institut de Planetologie et Astrophysique de Grenoble (IPAG), Grenoble, France.

Contributing Teams: the VIRTIS Team