Combined non destructive analyses applied to grains from the STARDUST track C2103,10

R. Brunetto1 ; A. Rotundi2 ; J. Borg3 ; et al.

1 Dip. Scienze Applicate, Università degli Studi di Napoli "Parthenope", Napoli (Italy) ;
2 Dip. Scienze Applicate, Università degli Studi di Napoli "Parthenope", Napoli (Italy) ;
3 "Astrochimie et Origines", Institut d'Astrophysique Spatiale, Orsay (France)

ABSTRACT

Ten grains from the Stardust track C2103,10 are analysed by different non destructive techniques that give indications both on the mineralogical and organic compositions of the particles (IR and Raman spectroscopy combined to FESEM and EDX). These grains have been extracted from different positions along the track, between the entrance and the terminal particle. Aerogel fragments originating from the same keystone are also analysed with the same techniques. The aim of this study is to obtain morphological, chemical, mineralogical, and organic characterizations of 81P/Wild 2 dust samples taking into account the slowing down evolution, fragmentation, and interaction with the aerogel of the incident grain.

In order to avoid handling and micromanipulation of the samples, we designed special sample holders, described elsewhere [1], that allow clean and safe particle transportation and multiple sample analyses. We performed a combined set of micro-InfraRed (IR) spectroscopy (transmission), micro-Raman, Field Emission Scanning Electron Microscope (FESEM), and Energy Dispersive X-ray (EDX) analyses. The IR analysis is performed using a synchrotron beamline at SOLEIL (France), which allows to map the samples with a spatial resolution up to ~3 µm.

A first IR analysis of the cometary grains and the nearby aerogel samples shows relevant contribution of the aerogel in the spectra of the extraterrestrial grains, as already largely observed (e.g. [2,3]). Melted or compressed aerogel, due to the grain slowing down process, is strongly mixed with the residues of the incident particles; the effect is more pronounced with respect to other Stardust tracks previously studied by PET analyses [3]. Two grains, extracted close to the entrance and the termination of the track, show clear IR organic signatures, due to aromatic and aliphatic compounds respectively. Silicates are detected in one grain extracted from the end of the track, both in the mid- and far-IR, mainly in the form of amorphous low-Fe olivine (forsterite), with a minor contribution of crystalline olivine and pyroxene. Amorphous carbon is detected by micro-Raman spectroscopy, a technique sensitive to the degree of disorder of the carbonaceous structure (e.g. [4,5]). The IR and Raman analysis is followed by electron microscopy investigation (FESEM and EDX) delivering complementary information on the composition of the grains. Preliminary results will be discussed.

We are grateful to K. Nakamura-Messenger and to the Stardust Sample Curation Team. This Research has been supported by the Italian Space Agency, Università “Parthenope” di Napoli, INAF, MiUR, Regione Campania, the French "Agence Nationale de la Recherche", and the French Space Agency CNES.