

COMBINED CHEMICAL/ELEMENTAL ANALYSIS AND CHARGING PROPERTIES MEASUREMENTS OF ITOKAWA GRAINS RETURNED BY THE HAYABUSA MISSION

F. Cipriani¹, M. Ferrari^{2,3}, V. Della Corte², M. Accolla^{2,3}, N. Drozdovski¹, V. Mennella⁴, A. Rotundi^{2,3}, D. Koschny¹, P. Vernazza⁵, L. Colangeli¹, O. Witasse¹ 1 ESA/ESTEC, Keplerlaan 1, 2200AG, Noordwijk, The Netherlands E-mail : fabrice.cipriani@esa.int 2 INAF-Istituto di Astrofisica e Planetologia Spaziali, Via Fosso del Cavaliere 100, 00133 Roma, Italy 3 Dip. Scienze e Tecnologie, Universita degli Studi di Napoli "Parthenope", Centro Direzionale I C4, 80143 Napoli, Italy 4 - INAF-Osservatorio Astronomico di Capodimonte, Via Moia-rriello 16, 80131 Napoli, Italy 5 Laboratoire d'Astrophysique de Mar-seille, CNRS

Introduction: The Hayabusa spacecraft collected submillimeter particles from the Muses Sea region on asteroid (25143) Itokawa on 19th and 25th of November 2005 [1,2]. We proposed to use Micro-Infrared spectroscopy, Micro-Raman spectroscopy, Energy Dispersive X-Ray spectroscopy, and FE-SEM imaging to measure not only elemental abundances and chemical characteristics of grains RB-QD04-0083, RB-QD04-0072, RA-QD02-0136-14, and RA-QD02-0126-12, but also their charging properties.

Sample holder and samples preparation: specific sample holders have been designed to meet the constraints of this unique series of measurement, carried out so far at the European Space Research and Technology Center (ESTEC) in Noordwijk, INAF/Istituto di Astrofisica e Planetologia Spaziali in Rome, and INAF/ Osservatorio Astronomico di Capodimonte (OAC) in Naples. Grains are glued with conductive epoxy at the tip of Tungsten needles fed through a Stainless Steel mounting block accommodated on modified SEM-stubs hosting Si calibration gratings in their centers. In preparation of any measurements to be performed with actual Itokawa grains, validation of the grains attachment procedure, holder mounting and measurements chain have been carried out with 10 to 30 microns Fosterite grains.

Micro-Raman and Micro-IR measurements: Micro-Raman measurements are performed at ESTEC with grains kept in the original JAXA containers using a confocal Micro-Raman spectroscopic system using an Ar ion laser beam at 514.5nm for excitation, and a long working distance objective. Micro-IR analysis is performed later on at OAC in transmission mode with an IR microscope attached to a FTIR interferometer (Bruker Equinox 55) in range 7000-600 cm⁻¹ (spectral resolution 4cm⁻¹) but first on analog grains prepared on supporting tungsten needles, in order to calibrate the measurements and estimate the contamination resulting from the epoxy glue.

FE-SEM imaging and Charging properties measurements : we use a Quanta FEG 650 at low voltage beam to 1) observe the grains morphology and 2) map the steady state electrostatic potential at the grain surface subject to charging by the incident electron beam. The beam energy is varied between 500eV and 2keV at this stage, while the combination of FE-SEM images of the grain and underlying substrate and an electrostatic model of the charging occurring in the FE-SEM chamber allows to retrieve the grain surface potential distribution where the surface is not covered by the conductive glue.

FESEM/EDX analysis: in addition, low voltage morphological observations are performed at OAC with a Zeiss Supra 25 equipped with an Oxford Inca Energy 350 with a Si(Li) INCA X-Sight detector followed by elemental analysis by EDX performed at 15keV.

References: [1] Fujiwara, A. et al, *Hayabusa Mission to Asteroid Itokawa: In-Situ Observation and Sample Return*, Dust in Planetary Systems, Proceedings, September 26-28, 2005 in Kaua'i, Hawaii. LPI Contribution No. 1280., p.50, [2] Yano, H. et al, 2006, *Science*, 312, 1350