EPSC Abstracts,
Vol. 2, EPSC2007-A-00348, 2007
European Planetary Science Congress 2007

Exploring a comet (APXS experiment within the Rosetta mission)

Jordi Gironés López (1), José Fernández Sánchez (1), Daniel Rodionov (1,2), Mathias Blumers (1), Iris Fleischer (1), Michaela Hahn (1), Jasmin Maul (1), Christian Schröder (3), Johannes Brückner (4) and Göstar Klingelhöfer (1)

(1) Institut für Anorganische Chemie und Analytische Chemie, Johannes-Gutenberg-Universität, Staudinger Weg 9, 55128 Mainz, Germany, (2) Space Research Institute IKI, 117997 Moskau,Russland , (3) NASA Johnson Space Center, 2101 NASA Parkway Houston, USA, (4) MPI Chemie, Mainz, Germany.

One of the principal objectives of the Rosetta mission of the European Space Agency (ESA) in collaboration with the Deutsche Zentrum für Luft- und Raumfahrt (DLR) is a better understanding of the origin of the solar system. For this purpose the study of comets is important as most of the comets formed more than four billion years ago and remained almost unchanged since then. There are also complex organic molecules present in the cometary material, which might be a key for the better understanding of the origin of life on Earth. This is another important objective of the mission.

The Rosetta Mission was launched in March 2004 and will reach its target, Comet 67P/Churyumov-Gerasimenko, after a ten year long trip including four fly-bys at the Earth and one at Mars. During the last Mars fly-by in March 2007, pictures were taken from a distance of some hundred kilometers and control tests were performed.

Rosetta consists of a Lander (Philae) and an orbiter, with nine and eleven scientific experiments respectively. One of the instruments on the Lander is the Alpha Particle X-ray Spectrometer (APXS; developed at the Max-Planck-Institut für Chemie, Mainz, and the University Mainz). This instrument will characterize a large number of different chemical elements once in contact with the ground contributing so to the aspirations of the mission.

For the elemental characterization the APXS irradiates the sample with alpha particles

and X-rays, emitted by a Cm-244 radioactive source. This irradiation has two different consequences:

- excitation of characteristic X-rays of most elements in the samples
- Back-scattering of alpha particles at the target nuclei.

These two processes are detected by two different types of Si-based detectors:

- The first one, used for X-ray detection makes it possible to characterize elements from Na to Fe and maybe above.
- The second one is for the detection of scattered alpha-particles and is used for the detection of C, O, N and some higher Z elements

Current status

The duration of the mission is quite long (more than 11 years) and all the equipment is supposed to be fully operational after a flight of more than 10 years. To avoid surprises and to check the functionality of the different scientific experiments during the cruise, periodical on-flight tests have been performed and will be performed until arrival at the comet. For the calibration of the APXS the inner side of the copper doors which protect the spectrometer from potential contamination are used as target.In the last tests of the spectrometer made in 2004 the results for both X-ray channel and alpha channel showed good working abilities and energy resolutions (within the nominal range). Just some parameters (thresholds) may be modified in the software to have a broader energy range.

To achieve the contact between the sensor head and the comet surface the spectrometer is mounted on a deployment device, which is responsible for the up and down movements. This device and its movements cannot be tested during cruise due to space limitations. Laboratory tests in a climate chamber under temperature conditions similar to those on the comet surface have been performed to verify in principal its functionality.