IN SITU ANALYSIS OF IRON MINERALOGY ON PHOBOS SURFACE BY MOESSBAUER SPECTROSCOPY. D.Rodionov[1,2], G.Klingelhoefer[1], M. Blumers[1], B. Bernhardt[3], I. Fleischer[1], J. Gironés [1], M. Maul[1], E.Evlanov[2], A. Shlyk[2], C. d'Uston[4], [1]Institut für Anorganische und Analytische Chemie, Universität Mainz, Germany (Staudinger Weg 9, Mainz, Germany, 55122, klingel@uni-mainz.de), [2]Space Research Institute IKI, Moscow, Russia (Profsouznaya Str., 84/32, Moscow, Russia, 117997, rodionov@iki.rssi.ru), [3]Von Hoerner & Sulger GmbH, Schwetzingen, Germany, [4]CESR Toulouse, France.

Introduction: Moessbauer spectroscopy is a powerful tool for quantitative mineralogical analysis of Fe-bearing materials. The miniature Moessbauer spectrometer MIMOS II [1] is a component of the Athena science payload on board of two Mars Exploration Rovers currently working on Martian surface. Both MIMOS instruments are operational after 6 years of work with total integration time over 1 year. The MER mission has proven that Moessbauer spectroscopy is a valuable technique for the in situ exploration of extraterrestrial bodies and the study of Fe-bearing samples [2,3].

Currently MIMOS II is part of scientific payload of "Phobos-Grunt" - Russian sample return mission to Phobos, one of the moons of Mars (Fig.1).

"Phobos-Grunt" mission: Originally, "Phobos-Grunt" was scheduled to launch in October 2009, but the launch was shifted to 2011 for additional testing of the spacecraft and payload to ensure mission success. Mission goals are:

- Sample return. Laboratory analysis of Phobos substance delivered to Earth;
- In situ and remote studies of Phobos surface including analysis of soil samples;
- Exploration of Phobos and its ambient space from orbiter.

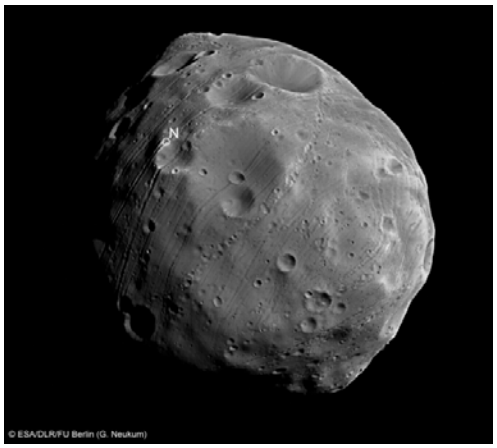

Fig 1. Mars' moon Phobos (Mars Express). Credits: ESA/ DLR/ FU Berlin (G. Neukum).

MIMOS II is mounted on the robotic arm (on the landing module, Fig.2). Scientific objectives are:

- Identification of iron-bearing phases (e.g., oxides, silicates, sulfides, sulfates, and carbonates);
- Quantitative measurement of the distribution of iron among those phases;
- Quantitative measurement of the distribution of iron among its oxidation states.

MIMOS II for "Phobos-Grunt": The Moessbauer spectrometer for "Phobos-Grunt" is based on the MER version [1] with some modifications and improvements. The new design includes additional mass reduction (sensorhead: ~450 g, electronics: ~ 100g). Instrument's firmware has been updated according to mission demands.

Fig 2. MIMOS II sensorhead mounted on the robotic arm.

A number of improvements were made to ensure optimal instrument performance at low temperatures (up to – 150° C). Fig. 3 shows Moessbauer drive error signal at temperature range 140 – 300 K.

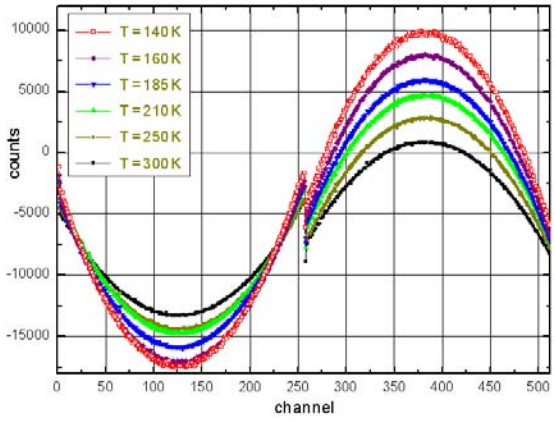

Fig 3. MIMOS II drive error signal.

Additional temperature calibration of detector system was performed to achieve best results at all temperature windows. Detector parameters are adjusted by firmware according to ambient temperature. Fig. 4 shows energy spectra of MIMOS II detector at temperatures down to 125 K.

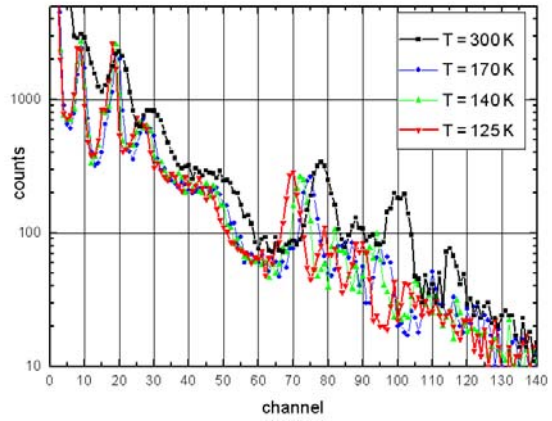

Fig 4. Energy spectra (Detector 3).

MIMOS II was thoroughly and successfully tested (vibration and shock tests) according to mission specifications (Fig.3).

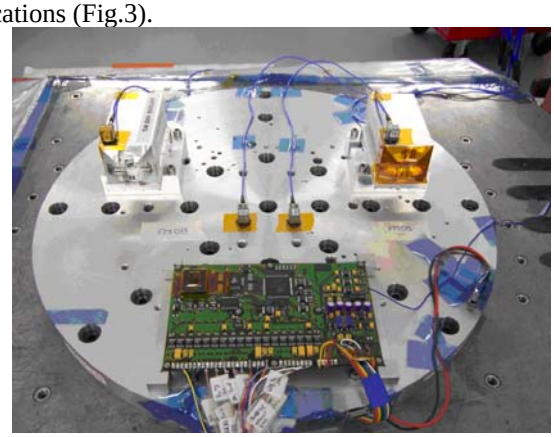

Fig 3. MIMOS II tests in France, Toulouse

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References: [1] Klingelhoefer et al., JGR. 108(E12) (2003), [2] Morris et al., JGR111 (2006), [3] Morris et al., JGR 111 (2006) *XXVII*, 1344–1345.