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X-Ray Diffraction and Fluorescence Measurements for *In Situ* Planetary Instruments

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Abstract

The ESA/NASA ExoMars mission, due for launch in 2018, has a combined X-ray fluorescence/diffraction instrument, Mars-XRD, as part of the onboard analytical laboratory. The results of some XRF (X-ray fluorescence) and XRD (X-ray diffraction) tests using a laboratory chamber with representative performance are reported. A range of standard geological reference materials and analogues were used in these tests.

1. Introduction

The XRD instruments are core components of the forthcoming NASA Mars Science Laboratory (MSL) and ESA/NASA ExoMars missions and will provide the first demonstrations of the capabilities of XRF /XRD instrumentation *in situ* on an extraterrestrial planetary surface. The University of Leicester team is part of the Italy-UK collaboration that is responsible for building the ExoMars X-ray diffraction instrument, Mars-XRD [1].

Mars-XRD incorporates an ^{55}Fe radioisotope source and three fixed-position charge-coupled devices (CCDs) to simultaneously acquire an X-ray fluorescence spectrum and a diffraction pattern providing a measurement of both elemental and mineralogical composition. The CCDs cover an angular range of 2θ = 6° to 73° enabling the analysis of a wide range of geologically important minerals including phyllosilicates, feldspars, oxides, carbonates and evaporites. The identification of hydrous minerals may help identify past Martian hydrothermal systems capable of preserving traces of life.

Here we present some initial findings from XRF and XRD tests carried out at the University of Leicester using an ^{55}Fe source and X-ray sensitive CCD [1]. The XRF/XRD test system, shown in Fig. 1, consists of a single CCD on a motorised arm, an ^{55}Fe X-ray source, a collimator and a sample table which approximately replicate the reflection geometry of the Mars-XRD instrument. It was used to test geological reference standard materials and Martian analogues.

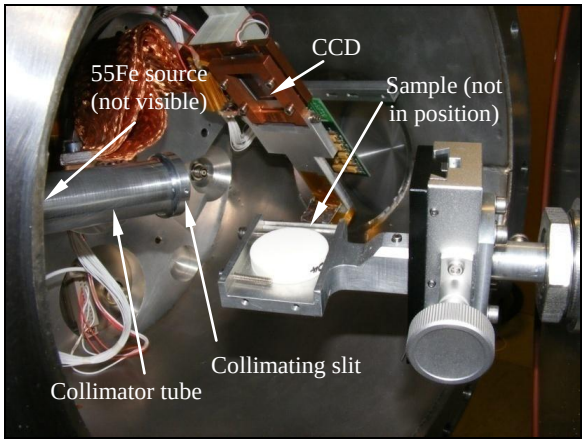

Figure 1: Photograph of the XRF/XRD test chamber.

Acknowledgements

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References

[1] Marinangeli, L., Hutchinson, I., Baliva, A., Stevoli, A., Ambrosi, R., Critani, F., Delhez, R., Scandelli, L., Holland, A., Nelms, N. & the Mars-XRD Team, Proceedings of the 38th Lunar and Planetary Science Conference, 12 – 16 March 2007, League City, Texas, USA.