VISTA-VOLATILE IN SITU THERMOGRAVIMETRIC ANALYZER: DETECTION OF VOLATILES IN PLANETARY ENVIRONMENTS

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Introduction: Thermo gravimetric analysis (TGA) is a common method to measure the volatile fraction of different compounds and it is also used to monitor the outgassing contamination in space and the moisture content in foods and the temperature profiles for firing ceramics [1, 2, 3].

Instrument concept: VISTA is an in-situ, miniaturized, instrument based on the TGA, designed to analyze the volatile/organic abundance in planetary regoliths. It exploits a powerful, but lightweight, Quartz Crystal Microbalance (QCM) with a built-in heater system This Heated QCM (HQCM) is able to perform μTGA measurements of fine grained particles (i.e. < 10 μm). Concepts of the instrument have been studied for sample return missions from asteroids (Marco Polo) and are under study for organic rich/astrobiological targets such as for the EJSM mission

Experimental results: Several measurements focused on the capabilities of VISTA of measuring the adsorbed water content of clay minerals have been successfully performed. In particular the material has been preliminarily exsiccated on the HQCM by means of several thermal cycles up to 100°C. The dried clay has been then exposed to a controlled flux of humid nitrogen to collect water molecules and then again warmed up to 70°C. At the end of the final heating cycle, the VISTA measurements showed the perfect correspondence between the amount of water collected and released by the clay (about the 3% wt).

Conclusions and future works: We successfully validated the μTGA potential onto a breadboard of the VISTA instrument. The design of a mechanical structure able to reach very high temperatures and containing the thermogravimeter with its proximity electronics is in progress. This new configuration will allow to perform thermal cycles (with maximum temperatures of 500°C) able to release organics or water present in the mineral structure of planetary materials.

References: [1] Serpaggi, F.; et al. J. Solid State Chem., 145, 580-586. 1999; [2] Stalport. F. ; et al., Geophys. Res. Lett., 32, L23205, 2005; [3] Wood, B. E., Proc. SPIE, 2864, 187-194, 1996.