

Visible and near-infrared reflectance spectroscopy of planetary analog materials. Experimental facility at Laboratoire de Planetologie de Grenoble.

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We have developed an original experimental facility designed to measure the bidirectional reflectance spectra of planetary analog materials. These measurements are helpful to interpret the observations of the spectrometers on board space probes in orbit around various Solar System bodies. The central part of the facility is the LPG spectrogonio-radiometer (Brissaud et al., 2004). This instrument provides measurements of samples BRDF (Bidirectional Reflectance Distribution Function) with high photometric and spectrometric accuracy in the spectral range of visible and near-infrared (0.3 - 4.8 microns). Measurements can be made at any value of incidence and emergence angle up to 80° . Azimuth angle is allowed to vary between 0 and 180° . The instrument was recently installed in a cold room allowing ambient temperatures as low as -20°C . This makes possible the measurements on different kinds of water ice samples (slab ice, frost, snow...) and mixtures of minerals and water ice with unprecedented accuracy.

We also have designed and built a simulation chamber to measure spectra of samples (water ice and/or minerals) under an atmosphere with perfectly controlled temperature, pressure and composition. The main objective of this last improvement is the study of water exchange between planetary regolith analogs and atmosphere (adsorption/desorption, condensation/sublimation). Experimental results will mainly apply to Martian water cycle and hydrated mineralogy. This simulation chamber also provides an efficient way to obtain bidirectional reflectance spectra of dry materials (removal of adsorbed water) with implications for planetary bodies without atmospheric or surface

water (Titan, asteroids...).

The reflectance spectroscopy facility is part of a large panel of instruments and techniques available at Laboratoire de Planetologie de Grenoble that provide complementary measurements on the same samples: infrared transmission spectroscopy of thin ice films, thick liquid and solid samples and samples diluted in KBr pellets, infrared imaging microscope, numerical modeling of bidirectional reflectance spectra using laboratory-measured optical constants.

We will present different examples of experimental results obtained on the reflectance spectroscopy facility:

- Effects of particle size, mixtures between samples with different albedo and measurement geometries on the water-of-hydration near-infrared absorption signatures with implications for the Martian regolith water content.
- BRDF of regolith analogs and natural snow.
- Hydration and dehydration of planetary analogs.
- Spectra of different kinds of mixtures between water ice and minerals.

We will briefly discuss the planetary implications of each of these measurements and detail the future investigations that will be undertaken on our experimental facility.