REFLECTANCE SPECTRUM OF MgSO₄·12H₂O: COMPOSITIONAL IMPLICATIONS ON THE SURFACE OF EUROPA JOVIAN SATELLITE. Prieto, O.¹,² Kargel, J. K., Quiñez, E. and Martínez, M. P.¹ ¹Faculty of Experimental and Technical Sciences. San Pablo CEU University. Spain. ²Astrogeology Team. USGS. USA. ³Faculty of Geology. Complutense University of Madrid. Spain. Email: olpriba@ceu.es

Introduction: Studies on NIMS Galileo spectra [1] shows that mineral composition of the surface of Europa includes some hydrated salts. These substances, such as hydrated magnesium and sodium sulfates and sodium carbonates, had been suggested to exist on this satellite from investigations of aqueous alteration of carbonaceous chondrites.

Terrestrial magnesium sulfate hydrates may be in some natural hydration states such as epsomite (MgSO₄·7H₂O) and hexahydrite (MgSO₄·6H₂O) minerals. There are already spectral data of the terrestrial salts in literature [2, 3, 4].

The hydration state of the salts depends on the planetary body surface conditions. As it has been discussed in [5] for Europa’s conditions (low pressure atmosphere and low temperature), it is possible that salts reaches its maximum hydration state.

Preliminary diffuse reflectance data for MgSO₄·12H₂O mineral is presented in this study.

Spectrum obtaining: A Cary-5E UV-VIS-NIR spectrophotometer equipped with an integration sphere has been used in this study.

MgSO₄·12H₂O has been synthesized in laboratory. It was carried in a sample holder designed for this study to the spectrophotometer. The sample holder was made from Teflon. It closes the salt sample with a quartz window that fit to the integration sphere. The sample holder has a small liquid nitrogen container in its back to maintain the hydrated sulfate in the lower temperature phase. As the sample holder is colder than the environment, the water vapor of the environment condenses on the quartz surface. This can alter the spectral results. To minimize this problem some tubes have been inserted in several perforated holes around the quartz window. An air current is continually pass through these tubes removing the atmospheric water vapor.

The reference material to make the baseline was Teflon. The diffuse reflectance measurements were taken using the following parameters for the near infrared range: data interval 1 nm, average time 1 s, bandwidth 5 nm, rate 60 nm/s. They were selected taken into account the broad peaks of the other hydrated magnesium sulfates already obtained and the unstability of the substance studied.

Results. Spectral data were obtained digitally. Only infrared data are presented in this study although data from 200-2600 nm have been taken. Ultraviolet and part of the visible region do not contain any important information for fresh unaltered MgSO₄·12H₂O.

Obtained diffuse reflectance data have to be taken cautiously because the water condensation and temperature problems. Besides there is not any X-diffraction data to test the sample state after the spectral measurement.

Figure 1 shows that MgSO₄·12H₂O and MgSO₄·7H₂O diffuse reflectance spectra are very similar. The curves have been smoothed in this presentation.

The broad absorption features in these hydrated salts spectra are caused by water molecules of their mineral structure. The higher hydrated sulfate has a flatter curve than the lower as it was expected. It is probably caused by the overlapping bands of water molecules occurring with slightly different bond-energy strengths, according to McCord et al. [1].

The MgSO₄·12H₂O spectrum fit better than other less hydrated magnesium sulfates to the NIMS Galileo spectra of non-icy material terrains.

MgSO₄·12H₂O spectrum will be used in studies about the alteration of sulfates due to irradiation that are being running.


Figure 1. Diffuse reflectance spectrum of MgSO₄·12H₂O and MgSO₄·7H₂O. Spectrum of MgSO₄·7H₂O is offset vertically for viewing purposes.