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1 - Introduction :

Titan, the largest satellite of Saturn, has a dense atmosphere composed mainly of N_2 and CH_4. The photochemistry of these two components leads to the formation of complex organic aerosols, from the upper atmosphere [1]. These solid particles are present throughout the atmosphere up to the surface, and have an important role in many processes taking place on Titan. Our aim is to constrain the news optical properties of these aerosols in the mid-Infrared spectral range (3 to 10 µm) determined by ellipsometry. We moreover considered two different samples representative of the expected evolution of the aerosols in Titan's atmosphere.

2 – Aerosol Production :

Analogs of Titan aerosols (tholins) are formed using the PAMPRE experiment [2]. PAMPRE is a reaction chamber, where a cold capacitively coupled radio frequency plasma is ignited at low pressure (~0.9 mbar). A gas mixture of 95% N_2 and 5% CH_4 is introduced into the reactor.In this study, two generations (productions) of tholins were performed, using the same gas mixture but injected at different flow rates. The variation of the flow rate allows to modify the residence time of the gas mixture in the reactor. Thus the chemistry evolves more or less slowly, and allows a more or less favored growth of powders. One of the two productions corresponds to tholins realized with the highest flow rate, and present a spherical nanometric morphology with average diameter of 400-500 nm [3]. The other production corresponds to tholins realized with a lower flow rate, presenting a spherical morphology but this time micrometric with an average diameter of 1-1.5 µm.

3 – Sample preparation for optical measurements : Compressed pellets

For ellipsometry, the surface condition (roughness) of the sample will have an important impact on the measurements, theoretically the samples should be specular. In our case, tholins particles were collected and compressed into pellets. These pellets consist of a base of KBr compressed beforehand, then a layer of tholins deposited on the surface of this base and compressed afterwards. To realize the compression, the sample is placed between two mirrors, in order to obtain a smooth surface. At the time of the compression of the sample of tholins, the composition of this layer is not homogeneous, it is necessary to take into account a mixture of air and tholins (porosity). The air included into pellets takes a part in the optical constants determined from the measurements made. To get rid of the effect of porosity, the compression rate was varied for the different samples.

4 - Optical analysis :

Reflectance measurements were performed on the surface of the pellets, using the ellipsometry technique, using an Infrared source. These measurements were performed in a spectral range from 3 to 10 µm (MIR), with a spectral resolution of 8 cm^{-1}. In the ellipsometry analysis used in this study, the polarimetric angles (Δ and Ψ) are deduced by muller theory for an isotropic case. In order to fit the measured data as well as possible, we applied a one-layer model with a Lorentz oscillator, allowing to infer the refractive index n and the extinction coefficient k.

5 - Conclusion and Discussion :

In this study, we propose new optical constants determined from Titan-like solid aerosols in the IR spectral ranges, to be compared with the previous determinations by [4] [5]. Morevover the measurements have been performed for two generations of analogues, with different physicochemical properties, which can simulate aerosols present at different atmospheric altitudes on Titan.

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