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Physcial and chemicla properties of analogues of Titan's aerosols produced with a radio-frequency plasma experiment

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The Titan's atmosphere contains aerosols produced by an organic chemistry induced by the photochemistry of N2 and CH4. These aerosols present in high atmosphere are at the origin of the characteristic brow yellow colour of Titan? These aerosols precipitate of the Titan's ground and give the appearance of a sandy beach as show the very well known photograph taken by the Huygens probe. During the Huygens descent two types of observations have been done concerning these aerosols: an upward detection of the solar light diffused by the atmosphere and the downward detection of the Titan's ground reflectivity. In order to produce "tholins", i.e. analogues of Titan's solid aerosols, we use a low pressure Radio Frequency (RF) plasma discharge. In RF plasma solid particles are produced into the gas, without wall effect, because they are maintained in levitation in the reactive medium by electrostatic forces. This type of discharge is used in the field of "dusty plasmas". In our experiment, the RF discharge works in a N2-CH4 gas mixture. The CH4 percentage is changed from 0% to 10% by adjusting gas flow a pure N2 and premixed N2 + 10% CH4. In order to study the influence of the plasma on the physical properties and chemical composition of the produced tholins plasmas parameter like total gas flow rate, total gas pressure and absorbed RF power are changed. In order to correlate the physical and optical properties of the different samples, the PROGRA2 experiment is used ex-situ. In this experiment, the particles are lifted by an air-draught in a cylindrical glass vial and lighted by two randomly polarized lasers at 543.5nm and 633nm via an optical fiber. The polarisation of the scattered light is measured in a 5° to 165° phase angle. The linear polarization

phase curves parameters are compared for samples produced in different conditions (e.g. CH4/N2 ratio changing from 2 % to 10 %). The results are correlated to the physical properties of the particles (constituent grains size distribution, aggregation) obtained by SEM microscopy. The reflectivity of the same tholins are measured using a spectro-photo-goniometer. The samples are lighted by a continuous quartz halogen light source and the reflected light is analysed in the visible and near Infra Red range. Results are compared with the ground reflectance measured by DISR instrument of Huygens probe. The apparent colours of the tholins varies from dark brown to 2% of CH4 to yellow orange for 10% of CH4. The dark colours for low CH4 percentages is confirmed bt the decay of reflectivity in the visible range.