

Investigation of the chemical structure and optical properties of Titan's tholins and "HCN polymer" by spectral analyses. Implications for the analysis of Cassini-Huygens observations and refractory organics in cometary grains

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Tholins and "HCN polymer" are used as analogues of Titan's aerosols and N-rich cometary refractory organics, respectively [1,2]. The chemical structure of these compounds is up to now not elucidate, as well as the identification of the parameters which do control their optical properties. This study provides new clues on the chemical structure of these compounds, and we discuss some implications for the analysis of spectral data of Titan and other icy satellites possibly covered by complex organics. Tholins produced from two different experiments located in Service d'Aéronomie (Verrières-le-buisson - France), and in LISA (Créteil France), and HCN polymer samples [1, 3, 4, 5], were studied by UV Raman spectroscopy [5,6], High Resolution Transmission Electron Microscopy and Infrared spectroscopy [7]. Our study show that all samples are hydrogenated carbon nitrides. They exhibit similar sp² structures, this latter being the key factor controlling the optical properties in the visible and near infrared spectral ranges [5]. Tholins formed from the different experiments are roughly similar, but they exhibit compositional differences which demonstrate that the derivation of physical parameters from remote sensing data may be extremely difficult, or even impossible. HCN polymer has a chemical structure similar to tholins, and strictly speaking, cannot be considered as a polymer. Its identification in cometary grains can be performed using UV Raman spectrometry. We will present the structural analysis, new reflectance spectral data of these samples, and we will discuss their implications for analysing spectral data of the surfaces of icy satellites, in particular Titan.

References: [1] Fray N. et al. (2004) MPS, 39, 581-587. [2] Imanaka et al (2004). Icarus, 168, 344-366. [3] Szopa et al. (2003) EGS-AGU, Abstract 8523 ; Szopa et al. (2006)