Investigation of Mixing Ratio of Methane on Titan and Determination of the Possible Dissolved Ingredients in Methane Lake

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Our laboratory at NASA Ames Research Center is engaged in determining the properties of Titan tholin and its role in of the cycling of methane in Titan's atmosphere and surface. Titan has been known to contain 2 - 8% methane and the balance nitrogen as the major constituents of the atmosphere. Recently, we have established that the tholin contains methane, ethane, ammonia, and possibly other minor ingredients during its synthesis. We are engaged in determining an accurate absorption of methane in the tholin from previously reported desorption as approximately 2.40 cc at NTP/g tholin. We have modified our apparatus to accomplish a more accurate quantization of the desorption by using pure methane in place of Titan gas (10% methane, balance nitrogen). The reasoning for this modification is logical; our first experiment attempted to accurately model a realistic atmosphere on Titan, while our second experiment attempts to more accurately determine the specific desorption of methane.

In view of future landing of a spacecraft in the Titan lake of liquid methane along with submerged Titan tholin in the lake, we are investigating the identification of ingredients dissolved in liquid methane from tholin or other sources such as the byproducts emerging during the synthesis of Tholin in the atmosphere of Titan. Raulin (1987) has predicted from theoretical calculation that the liquid methane may contain trace amounts of ingredients dissolved at surface temperature (90 K). Previous laboratory experiments have suggested low solubility, less than 0.03%. (McKay 1996)

Besides an accurate amount of CH_4 desorption from tholin at liquid nitrogen temperature, we will present our home built apparatus to measure the solubility and the identification by GC and GC/MS.

References

McKay, C.P., Elemental composition, solubility, and optical properties of Titan's organic haze. Planet. Space Sci, 44, 741-747, 1996.

Raulin, F., Organic chemistry in the oceans of Titan. Adv. Space Res. 7, 571-581, 1987.