FORMATION OF ALIPHATICS ON SILICATE FILMS: COSMIC GRAINS EXPERIMENTAL SIMULATION.

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Introduction: The Chondritic Porous Interplanetary Dust Particles (CP-IDPs) are assumed to be the most pristine extraterrestrial particles available in the laboratory for studies with high spatial resolution analytical techniques. We have recently performed a systematic study on a set of twelve CP-IDPs and found a relationship between the mineral and organic components of the studied samples. The olivine-rich IDPs (ol-rich) have their aliphatic chain lengths longer than the pyroxene-rich ones (px-rich) [1]. This result, which has never been reported before, seems to indicate that the silicate components play a major role in the formation and/or evolution of the organics on the surface of the extraterrestrial matter.

We have thus developed in the laboratory experiments aiming to simulate the formation, in the primitive nebula or in protoplanetary environments, of organics on silicate surfaces. This preliminary study has been conducted to check whether the observed result on the IDPs can be obtained in the laboratory.

Experiments: Different silicate thin films of various compositions and structures; amorphous San Carlos olivine (am-SC), crystalline SC olivine (χ-SC), amorphous pyroxene (am-px), χ-pyroxene (χ-px) and a mixture of χ-SC and px (χ-SC+px) as well as a naked diamond substrate, used as a blank, have been used. The films have been synthesized on diamond substrates according to [2]. All these samples have been exposed in a tubular furnace during two months to a ~50 mbar gaseous atmosphere composed of CH_4, NH_3 and H_20 in the proportion 2:1:1 heated at 400°C. The diamonds have been maintained in the portion of the tube at ambient temperature to obtain a cold condensation point. To monitor the evolution of the silicate films, we used infrared (IR) spectroscopy. For each studied sample, mid-IR spectra have been acquired before and after the heating experiments. By subtracting the two spectra for each sample, the evolution of the feature around 3.4 µm can be investigated.

Results: We recorded a gradual decrease of the pressure in the tube; indicating thus an adsorption of the gas on the surfaces. The reduced data of the am-SC film showed a very weak feature around the 3.4 µm region containing the CH_2 and CH_3 bands as those generally observed in the extraterrestrial matter. It is interesting to note that the χ-px film exhibit a unique band around 2950 cm^{-1} which can be attributed to CH_3 asymmetric vibration mode. This is in good agreement with what is observed on the CP-IDPs where the px-rich IDPs have a smaller CH_2/CH_3 ratio as compared to the ol-rich IDPs. The obtained data are noisy and the features quite weak (a maximum absorbance of ~0.1% ± 0,015%). These promising preliminary results have to be confirmed using, first, longer exposure times and secondly, ^{13}C instead of ^{12}C in order to ensure that the observed features are not due to contamination. This work is still under progress.

References: [1] Merouane S., Djouadi Z. and Le Sergeant d'Hendecourt L. 2014. *The Astrophysical Journal* 780:174. [2] Djouadi Z. et al. 2005. *Astronomy & Astrophysics 440*, 179–184.