ORGANIC COATINGS DEPOSITED BY FISCHER-TROPSCH-TYPE REACTIONS.

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Introduction: The early solar nebular is a vast chemical factory that produces a plethora of compounds and solids some of which were likely organic [1]. One possible method to generate hydrocarbons in the early solar nebula is via Fischer-Tropsch-type (FTT) reactions. These are surface-mediated rections that hydrogenate CO (& N_2) into increasingly complex hydrocarbons. Our experience with these reactions revealed that the coating deposited on the grains during the experiments proved to be an efficient catalyst [2]. A preliminary examination showed that the coating itself appears to be composed of insoluble organic matter (IOM) and could be reminiscent of the organic matrix found in some meteorites [3]. We are now studying the produced oragnic coating in greater detail.

Experimental setup: The FTT reactions are conducted in a closed gas circulating system that monitors evolved gases in real time using Fourier Transform infrared spectroscopy. The initial solid sample (powdered Fe, magnetite, or iron silicate 'smoke') is heated to a predetermined temperature, a gas mixture of CO, N_2 and H_2 is circulated around the sample until CO is sufficiently depleted. Vacuum is then pulled, the bulb is refilled with the same gas mixture and another cycle is run using the same catalyst. Up to 20 cycles are typical for one sample. A complete description of the experiment methodology can be found in previous publications [2,4].

Analytical Methods: The resulting solid organic products were analyzed at NASA Johnson Space Center by pyrolysis gas chromatography mass spectrometry (PY-GCMS). PY-GCMS yields the types and distribution of organic compounds (both aromatic and aliphatic) released from the insoluble organic matter generated from the FTT reactions. We also measure the change in surface area of the samples using a gas sorption analyzer.

Discussion: Initial results from the PY-GCMS suggest a change in ratio of aliphatics to aromatics that is dependent on temperature and also reaction time/cycle [5]. The change in surface area also appears to be related to the initial starting material. It will be interesting to see the correlation between these parameters and what implications they might hold for the changing chemistry of the nebula. These experiments and analyses are ongoing and the results will be discussed.

References: [1] Nuth J. A. III and Johnson N. M. 2005. Abstract #1849. 36th Lunar & Planetary Science Conference. [2] Nuth J. A. III et al. 2008. *Astrophysical Journal* 673:L225-L228. [3] Johnson N. M., Cody G. D. and Nuth III, J. A. 2004. Abstract #1876. 35th Lunar & Planetary Science Conference. [4] Hill and Nuth J. A. 2003. *Astrobiology* 3:291-304. [5] Locke D. R. et al. 2015. Abstract #1986. 46th Lunar & Planetary Science Conference.